

NOVEMBER 1976 75 CENTS

# Popular Mechanics

**CB RIP-OFF:  
12 WAYS TO  
CUT THE ODDS**

**PLANS! 2 GREAT PLATFORM BEDS &  
A MAGNIFICENT STEREO WALL**

**COMEBACK OF THE  
31 MODEL A  
ROADSTER**



**NEW U.S.  
BATTLE TANK:  
MADE IN  
GERMANY?**

**THE LAST WORD ON  
PHONO RECORD CARE**

**Daring undersea tunnel  
through an earthquake zone**

**DIRT BIKES that become street bikes**

**Walks and drives that shovel themselves**





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GNQP-1CW-BSKN



# Popular Mechanics®

NOVEMBER 1976

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VOLUME 146 NUMBER 5

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**On the cover**  
U.S. Army's two XM-1 main battle tank prototypes and West Germany's Leopard II are being tested at Aberdeen, Md., proving grounds—one may be designated as NATO's new standardized tank.  
*Illustration:*  
Ed Valigursky



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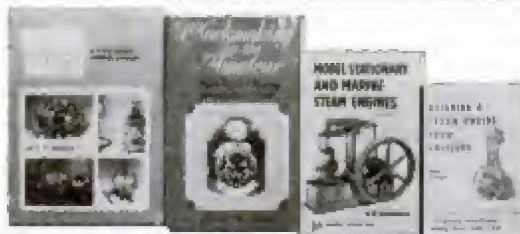
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# The 6½" speaker that makes fire, crime and disaster sound beautiful.



Because the powerful double-range 6½" speaker in the Tech 800 has a double-layer outer cone for bass and mid-range. A mylar inner cone for treble. And sound so big, it's hard to believe it comes from a portable.

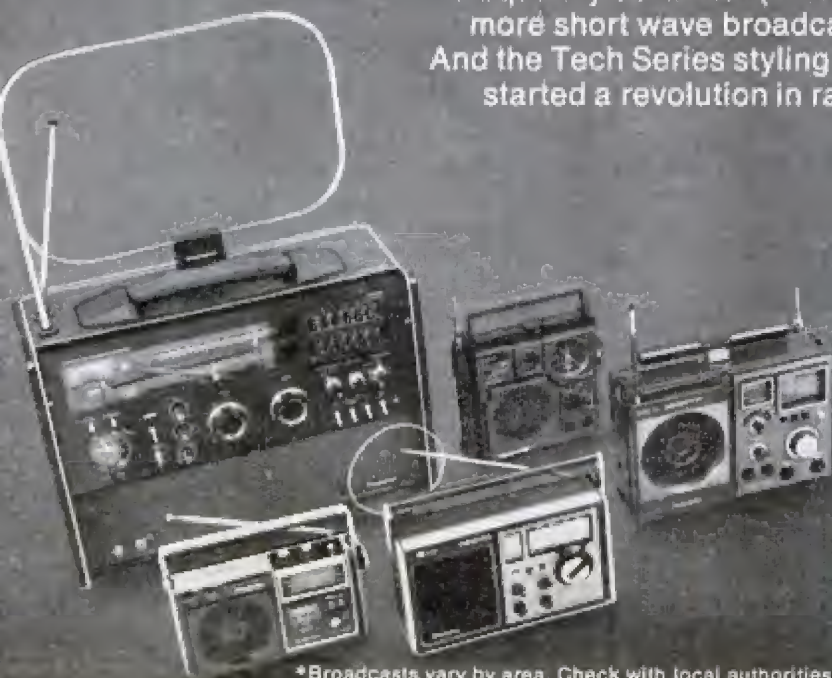
Not only the sound of FM and AM, but the 24-hour sound of real life drama—police, fire, emergency—on the Tech 800's VHF-High band.\*

With all that big sound, you also get all those nice little deluxe touches: Separate bass, treble and squelch controls. Loudness switch. Built-in PA system... and, of course, Panasonic batteries.

## Now also makes London, ships at sea and Smokey the Bear sound good.

Because now that same powerful 6½" double-range speaker is also in the Tech 1000. And the Tech 1000 brings you a whole new world of radio.\* Two short wave bands. A marine band. And the most exciting sound in years—citizens band.

All this plus AFC/DX-local circuitry for better FM/AM. With gyro and telescoping whip antennas for better reception. A beat frequency oscillator (BFO) for more short wave broadcasts. And the Tech Series styling that started a revolution in radio.



\*Broadcasts vary by area. Check with local authorities.

**Tech  
series**  
**Panasonic.**  
just slightly ahead of our time.



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Robert A. Georgine.

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"Studies show a close correlation between a nation's energy use and the economic well-being of its citizens. If electric supply facilities cannot be constructed as needed, power shortages will result which will inevitably affect both industry and commerce.

"And that means losses in jobs. Already, certain areas of the country have experienced job losses as a result of energy shortages.

"As our nation's resources of natural gas and oil are further depleted, this country must turn to coal and nuclear fuels, at least for the near and mid-term future.

"Nuclear energy is generated from a fuel which will not soon be depleted and a fuel which this country can supply. It is energy future jobs can depend on.

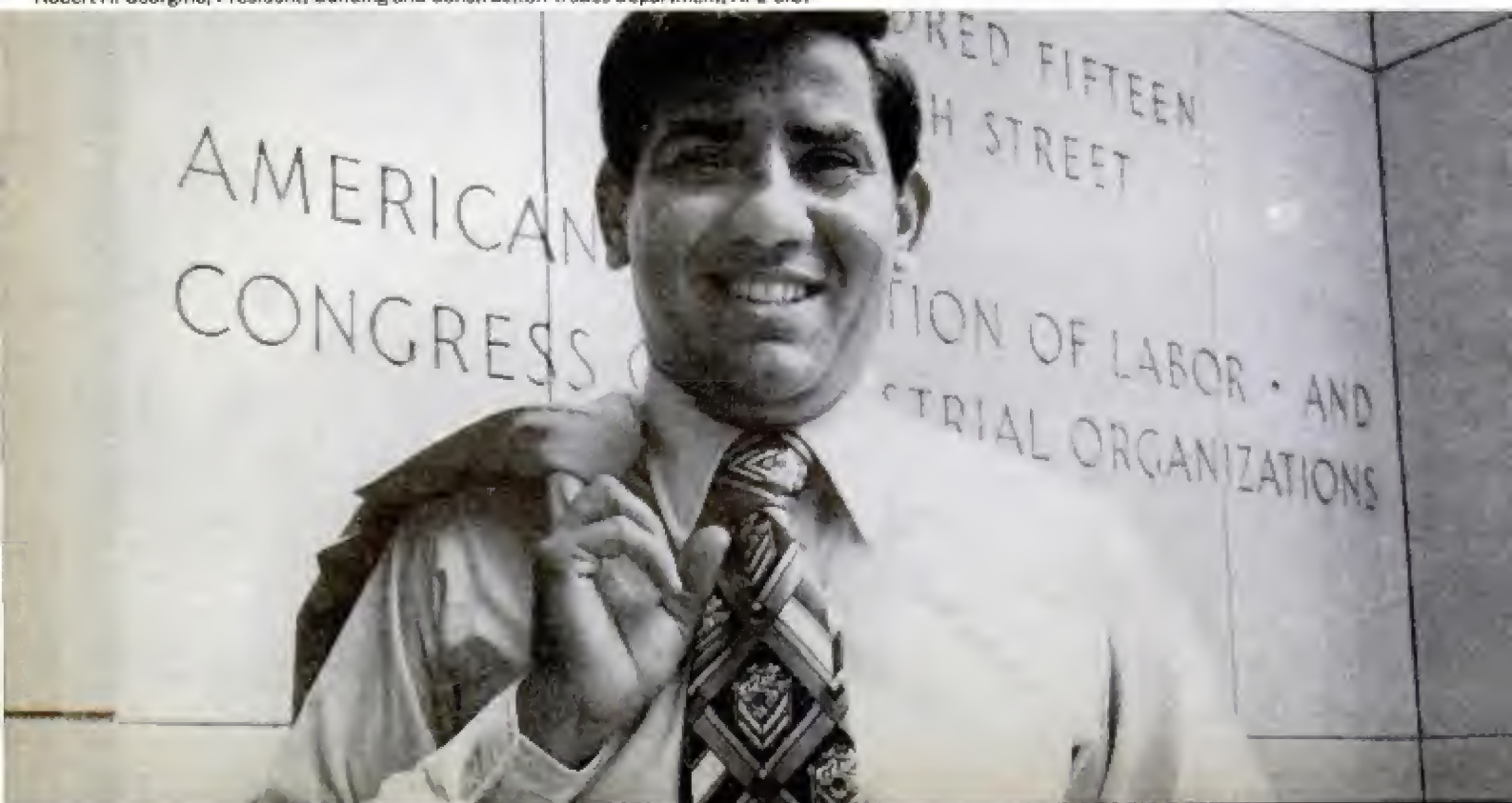
"Compared to fossil fuels, nuclear energy is significantly cheaper. This means savings for consumers and electric rates that encourage industry to expand and create new jobs.

"For all these reasons, I urge you to support nuclear power. America badly needs the new jobs this energy can help assure."

**Edison Electric Institute  
for the electric companies**

90 Park Avenue, New York, N.Y. 10016

Robert A. Georgine, President, Building and Construction Trades Department, AFL-CIO.





# LETTERS

## TO THE EDITOR

### Down on the farm

Bill Kilpatrick was really off course (to put it mildly) when he said those \$50,000 four-wheel-drive monsters are typical (*Down on the Farm with Four-Wheel Drive*, page 76, Aug. '76). I live on a "typical" farm and the biggest tractor doesn't have half that many horses. Those things cost half what the average dairy farm costs. I'd like to kick Bill Kilpatrick! We are not millionaires! JEFF DAVIS  
ABBOTSFORD, WIS.

As head of the Tractor Test Laboratory of the University of Nebraska, I have a few remarks which are elucidations on points which might be misleading.

■ Compaction and its results are functions not only of the area but also of the total weight (you compact a larger area—perhaps to a smaller depth—when you have eight instead of four tires), the soil moisture and its distribution with depth at the time of the operation, the presence of deep winter frost which tends to undo a lot of the compaction results, soil type, etc.

■ Fuel costs per hour are certainly not lower for these large units. What may be lower is the fuel cost per acre per hour.

■ You mentioned nine manufacturers but actually there are several smaller manufacturers (Big Bud, Rite 404, Knudsen, Woods & Copeland, etc.) who also take their part in the market. DR. LOUIS I. LEVITICUS  
LINCOLN, NEBR.

A lot of people think there really isn't that much to working a tractor, especially with air-conditioning, stereos, soundproof cabs and other options. You have to have an all-season soundproof cab to keep your health and stereo to keep from going to sleep.

STEVEN BOYCE  
QUINCY, WASH.

### Air traffic control

I am a member of the Professional Air Traffic Controllers Organization and have been an air traffic controller for six years. In *Collision Course* (page 64, Aug. '76), you state: "Since 1949, 558 persons have lost their lives in seven major air collisions". Seems to me, that considering the billions of air miles

(Please turn to page 8)



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## LETTERS

(Continued from page 7)

traveled since 1949, that is an enviable record.

The "considerably sophisticated collision avoidance system" that you speak of is very inadequate. "At Crabs," as you say controllers call it (I've never heard that), is a system that generates thousands of false alerts in this country every day. Controllers, and not machines, are responsible for "collision avoidance." The human element, either pilot or controller will never be eliminated from aviation. What needs to be eliminated is the continually increasing workload being placed on controllers because of technology.

MICHAEL W. CURTIS  
LONGMONT, COLO.

Perhaps your average reader is richer than myself, but I do not consider \$1000 per plane for a B-CAS system to be "not particularly expensive."

It is not my contention that we should sacrifice lives in order to save some money. But your article stated that there have been 558 persons killed in midair collisions since 1949. That is 20.7 persons per year. And how many are the highways killing per year? 40,000? 50,000? Gentlemen, your intentions are admirable but your priorities are wrong.

WALTER RUSSELL  
BOONE, COLO.

You stated: "Considering the thousands of flights made safely every day, the system has worked well and the men who man it do a remarkable job." Have you not considered that thousands of women also do this "remarkable" job?

PFC NANCY B. AURAND  
FORT SILL, OKLA.

### Cloak-and-dagging

*How to Eavesdrop on Cloak-and-Dagger Radio* (page 72, Aug. '76) was, pardon the pun, most intriguing. But when you report the Czechoslovakian Embassy in Washington transmitting "home" to Warsaw, wouldn't that get Prague awfully upset?

GEORGE H. WOLFF  
SAN JUAN, P. R.

My associate and I have been investigating these so-called "Spanish Numbers" transmissions for approximately nine months. During this time we have accumulated a vast amount of information. Mr. Curtis failed to mention the Longwave Club of America and its monthly publication, *The Lowdown*. This club is entirely devoted to DXing below

550 KHZ.

WILLIAM T. GODBEY  
WEST PALM BEACH, FLA.\*

One major club was not listed that should have been: Canadian International DX Club. They have a utility (cloak-and-dagger) loggings column every month as well as a monthly column on the types of broadcasts talked about in PM. Membership is open to Americans and overseas listeners as well as Canadians.

DOUGLAS B. STOTZ  
GREENFIELD, MASS.

### Trucker's life

I am becoming somewhat tired of seeing articles by or about truckers crying that they are unable to remain in business without breaking laws passed for their protection and mine (*Truckin'*, page 60, Aug. '76). We expect other businesses to operate within the confines of the laws that pertain to that business, and I can see no good reason not to expect truckers to do the same. The use of CB radios or other devices to avoid compliance with traffic laws is illegal and dangerous, and I find I am unable to sympathize with those who deliberately break the law and then complain when police enforce the law.

JOHN H. WILLOCK  
CHESTERTOWN, MD.

### The tailgating accident

I never thought I would write you because truly I was never interested in your magazine; my husband is the mechanic around the house.

I was intrigued when I noticed *How to Evade the Deadliest Highway Trap* (page 86, Sept. '76). I tell you, I sat down and immediately started reading this article. It is so complete! It made me realize the shocking truth of how an unalert tailgater would end up. By having this type of educational article, you are showing how you care for your readers.

BETTY LAMBERT  
SUMTER, S.C.

### They'd rather Jetfoil

Reading about Mrs. Deku's Jetfoil trip from Oahu to Maui (*Letters*, July '76) somewhat dampened our anticipation of the voyage.

We found it very relaxing, and every one was very courteous from the captain on down. There were 12 to 14-foot swells, and we saw no one ill. The passengers were having a good time—according to the laughter and picture taking that we saw.

If you're in a hurry, by all means take a plane. For us, we're looking forward to another Jetfoil boat trip.

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\*U.S. Dept. of Labor Bulletin 1824



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## 11 kits with Quadraphonic Stereo and B/W TV...\$550

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## 11 kits with 19" diagonal color TV...\$880

or low monthly terms

The course includes 42 lessons and 4 reference texts plus kits and experiments to build a superb solid-state 19" diagonal color TV receiver... complete with cabinet, and engineered specifically for training by NRI's own engineers and instructors. This handsome set was designed from the chassis up to give you a thorough understanding of circuitry and professional trouble-shooting techniques. You build your own solid state volt ohmmeter, CMOS digital frequency counter, and experimental electronics Discovery Lab.

## 14 kits with 25" diagonal color TV and Quadraphonic Stereo...\$1195

or low monthly terms

The ultimate home training in Color TV/Audio servicing with 48 bite-size sessions, 10 reference texts, and 14 training kits... including kits to build a 25" diagonal color TV, complete with console cabinet; a 4-speaker Quadraphonic Center; a wide band, solid-state, triggered sweep, service type 5" oscilloscope; digital integrated circuit color TV pattern generator; a CMOS digital frequency counter, and an electronics Discovery Lab. This gives you both TV and Audio training for hundreds of dollars less than the tuition cost of TV and Audio combined from the next leading school.

This Master Course combines theory with practice, using the "Power-On" stages for experimentation and learning. Building NRI's equipment will give you the confidence and ability to service any color TV or Audio unit on the market. And you'll have a magnificent TV and quadraphonic system for years of trouble-free performance.

## Advanced Pro Color with 19" diagonal color TV...\$665

or low monthly terms

An advanced Color TV Servicing Course for experienced technicians, 18 lessons, 5 new "Shop Manuals", and NRI 19" diagonal Color TV receiver with cabinet.



# DETROIT LISTENING POST



## Fix-it-yourself Fiesta

Rival automakers who have got their hands on the German version of Ford's Fiesta, due in the U.S. in April, are lavish in their praise of the car from a service standpoint. They say it could be the easiest, cheapest car to service since the Model T. That's a high recommendation considering the source of the information.

Ford has done two things to the car to make it a cinch to service. First, it has a lot of do-it-yourself features. Second, high-wear parts requiring frequent service or replacement have been designed and/or positioned to make them easily accessible if a professional mechanic has to do the job. This means less labor time.

Rival manufacturers are now running evaluations on Fiesta. This is standard practice when a new car comes out. The competition buys a copy and does a series of us-versus-them comparisons—from an engineering standpoint, durability, service, price, the works. In the service area, the companies do time studies on how long and what it costs to repair or replace everything on the car. It will be interesting to see what the labor time allowances are on Fiesta when the car goes on sale in this country. If Ford has really one-upped the industry, it could force competing carmakers to do some extensive reworking of mechanical layouts.

## Big engine or small?

Speaking of service, here's an angle to give some thought if you plan to buy a '77 car. Most '77s have smaller engines than in the past. This trend will continue for the next several years. Engines will become even smaller. If you don't want the small standard engine, you can still special order an optional big engine on most makes.

Trouble is the bigger engines gobble more gas. Okay, so you know all that. But here's something you might not know. Small engines require more service than big engines. The parts wear out faster on small engines. So what you save in the price of gas with a small engine

could be wiped out by higher repair bills if you keep a car a minimum of three years. Manufacturers of replacement parts are rubbing their hands in glee over the switch to smaller engines. This is not an endorsement of big engines over small engines. Carmakers and dealers like to sell you the biggies because there's more profit in them. It's a six-of-one, half-dozen of something else to think about in buying a new car.

## New view on old cars

Detroit has never had any real interest in what happens to a car after it reaches a certain age and piles up a certain number of miles. After two to three years or 40,000 to 50,000 miles, Detroit figures you ought to buy a new car. The factories don't want to hear your problems with the old car and they are interested in you only as a prospect for a new car.

That attitude is changing. GM and Ford are developing programs to do research on what happens to a car at 50,000 miles and what can be done to keep it going. They would still prefer to sell you a new car. But as the price of cars go up, more people hold on to their cars longer than they used to. The manufacturers are concerned about this trend. By helping you keep the old car going another year or two, the companies hope to keep your loyalty when the time comes to trade for a new car.

## Lemon aid phone service

The National Highway Traffic Safety Agency has been offering a free phone service for several months to tell people buying used cars if the car was involved in a recall to correct a defect and, if so, if the defect was actually repaired. The phone number is 800-424-9393 and you have to call between 8:30 a.m. and 5 p.m.

There's some question about how long the service will continue. If enough people call, the service will be put on a permanent basis. That decision will be made just about the time you receive this issue of PM. So you take your chances if you call. The number may be in operation or may have been disconnected. But the call won't cost you anything either way.

## GM tops '78 mileage goal

Last December the government put the auto companies on notice that beginning in 1978 and continuing through 1985 cars will have to average a specific number of miles per gallon of gas. The mpg goes up year by year. The '78s are supposed to average 18 mpg and the '85s are supposed to take you 27.5 miles on a gallon. If the companies don't meet the objectives, they can be fined for every car that falls below the target figure.

The companies have been crabbing that the government goals are impossible. They say the only way they can comply with the law is by shrinking all cars to the size of Chevette and Pinto.

It now seems there may be another way of skinning the cat, as GM has done with Olds Toronado. By using a new spark timing system on Toronado, GM has increased the fuel efficiency of the car to a point where the company can claim its '77 products average 18.4 miles to the gallon. That's even better than the government standard calls for next year, on the '78s. You can't get 18.4 to the gallon with Toronado. You get 15, at best. But if you average Toronado's mileage in with GM's other cars, the company can honestly claim that on a fleet basis its cars average 18.4 to a gallon of gas.

The government formula doesn't require that all cars give X miles to the gallon. Some cars can be above X, some below. But on a sales-weighted basis—when you add up sales of all cars produced by a company—mileage has to average X. So the trick is to improve the fuel economy of the gas-guzzlers at the bottom. That's the approach GM is taking and it is a strategy the other firms will have to follow to bring their cars in line with the law. It's that or rewrite the law.

## How's that again?

Chrysler wanted to put together a list of hints to help people shop for used cars and asked its dealers to pass along ideas. My favorite is suggestion No. 3: Be prepared to pay more for the car than you expect to pay.

\*\*\*





# The night belongs to Charger.

If your pulse quickens after dark, Charger is your car. Charger has a look that was shaped for the night. An excitement to match your mood when you've left the day behind.

Close yourself in Charger, and the dark lights up. You're hugged by high-back bucket seats. Before you, a full array of controls for night cruising. A standard 318 V8 links to the TorqueFlite automatic

transmission to let you glide around all those everyday cars.

When the sun goes down and the lights come up, move into Charger time. Some of us were born for the night. Now we have a car that belongs to us. Charger. Get one at your Dodge Dealer's.

## '77 Dodge Charger





# ALL OUTDOORS

WITH BILL McKEOWN



## Hunting season hint

Eating venison is no problem, but not many deer hunters know how to tan hides and then fashion clothes from them. An excellent source we have found is Mid-Western Sport Togs, Berlin, Wis. 54923. Their catalog shows fringed and regular jackets, shirts, vests, moccasins, gloves, handbags and hats that can be custom-made from hides you supply. Hides can be shipped to them raw or tanned, or Mid-Western can handle the tanning and drying of salted skins. Instructions tell how to prepare and ship hides, and how to figure needed square footage for various garments. They also tailor clothes from their own skins, or can supply the leather necessary if your hides are insufficient.

Savings are substantial. A deer-skin jacket custom-made to your measurements can cost \$143 from their stock, but it's only \$36 if you supply the hides. Gloves at \$10.75 are only \$4.25 from your deerskin. Tanning of deer, elk or antelope costs 65 cents a square foot in cream color; skins can be re-dyed to saddle tan or dark brown.

## Talking turkey

Fans of that wily and flavorful bird, the wild turkey, can now help support him and increase his habitat by buying the first annual wild turkey stamp for \$3 from the National Wild Turkey Federation, Box 467, Edgefield, S. C. 29824. Unlike the Federal duck stamp, the new turkey stamp is not mandatory for hunting, but is tax-deductible. Even if you are only a stamp collector, this colored rendition of the Florida Osceola should be worthwhile; the original duck stamp issued in 1934 is reported to have gone up 60 times in value.

## Public preserves

This year's season doesn't have to end, especially for scattergunners. A new 1976-77 North American Shooting Preserve Directory is in print. Many preserves are open after regular seasons have ended and some now offer clay-target shooting and fishing as well. The directory is free

from the National Shooting Sports Foundation, 1075 Post Rd., Riverside, Conn. 06878, send a stamped, self-addressed envelope.

## Paddle your own

The quiet old-time art of canoeing is becoming so popular that many new craft are appearing, and books and booklets telling where and how to buy, rent and use them are being published. The Coleman Co. has announced a light and durable model which will be added to its camping equipment line, and canoes in aluminum and plastic have recently been introduced by other makers.

To get a start or try more advanced canoeing, *The Canoeer's Bible*, \$2.50 from Doubleday, is an inexpensive guide. Advanced rafting, canoeing and kayaking through really rough water is well described and illustrated in *Whitewater!* by Strung, Curtis and Perry for \$14.95 from Macmillan. For all instructions you'll need to trip into the back

country, try Davidson and Rugge's *The Complete Wilderness Paddler*, \$10, published by Alfred Knopf. It tells you how plus why you would want to. The feel and appeal of the sport is here in a particularly well-written volume that's a pleasure to read and may deserve the rating of definitive as well.

## Gun notes

An estimated 7 million people have graduated from state-sponsored hunter-education programs since the first one was started by the New York State Conservation Dept. in 1949. Similar courses now in 49 states teach hunting ethics and tradition, fundamentals of safe shooting, firearm and ammunition basics, hunter responsibilities, game identification, first-aid and wilderness survival. The courses, voluntary in 29 states, are required in 23 before a youngster can get a hunting license. State wildlife agencies can usually tell you where classes are available.

Marlin Firearms Co. will again sponsor a hunter safety contest in cooperation with state programs. Youngsters who complete courses by the end of February 1977 will be eligible, and awards will go to state and national winners. Last year's contest drew entries from 34 states.

Two recent guns of interest include the Mini-14, a scaled-down Ruger version of the famous Garand-type rifle. The little compact autoloader fires a .223 cartridge and, at \$200 at Ruger dealers, has been dubbed "the world's most expensive plinker." It will be available with five, 10 and 20-shot box magazines. Crosman Arms reports it is changing the caliber of its .38 replica air pistol from .22 to .177 due to popular demand. With single or double action, the pistol with the weight and feel of a larger gun carries six pellets in its revolving cylinder. The smaller caliber is said to offer increased velocity and accuracy.

One last Bicentennial note: From DBI Books, Northfield, Ill., a new \$7.95 book by James Serven, *200 Years of American Firearms*, gives a fine retrospective look at guns dat-

(Please turn to page 16)



Mariner is a new name and shape for outboard power. Engines range from 2 hp (above) through 3.5, 5, 8, 15, 20, 25, 28, 48 and 60 up to 85 hp. Popular abroad for several years, the line is built in Japan for Mariner International, Fond du Lac, Wis. Like Mercury, it's a Brunswick Corp. division.





**How come  
I enjoy smoking  
and you don't?**

It's got to be my cigarette. Salem gives me great taste. And enough fresh menthol to keep things interesting.

You'd enjoy smoking, too, if you smoked Salem.

**Salem.**

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report APR. '76.



## ALL OUTDOORS

(Continued from page 14)

ing from colonial days to the present, with copious illustrations of each.

## CBers take note

If your next camping trip will cross into Mexico or Canada and you have a citizens band radio in your vehicle (you're missing a lot if you don't), apply for special papers in advance. The set might be taken away from you or sealed if you haven't. Because of the backlog of requests, write at least two months in advance to the Secretary of Communications, Mexico City DF. For Canada, contact the regional office of the Canadian Department of Communications for the province you will be visiting. The AAA can give additional help.

### RVs on the upswing

A look at any interstate indicates the recent rapid growth of motor campers, and Doug Toms, president of the Recreational Vehicle Industry Assn., confirms it with a five-year projection that shows small mini-motorhomes will probably be most popular in 1980 with travel and camping trailers a close second. Pickup camper production will probably be slightly less by then and fifth-wheel trailers stay about the same. Recent recessions and gas shortages, according to Toms, show that outdoorsmen may cut back, but won't give up leisure activities. The high cost of living, he notes, has attracted even more people to RVs, camping and inexpensive outdoor fun.

For the most helpful public agency to realize RVs are here to stay, this department's award goes to the Ohio Turnpike Commission. Its rest and toll stops along Interstates 76, 80 and 90 list places to camp, stops with trailer and holding-tank facilities right along the pike, trailering suggestions, motel listings—nine aids in all. Six of the 16 service plazas even have overnight electric and water hookups. Information can be picked up when you enter the Turnpike or by writing in advance to the Ohio Turnpike Commission, Berea, Ohio 44017. One state, at least, is glad to see us.

If your RV is a trailer boat and you are heading West or live there, the aid that may help most is a new book, *Blackburn's Guide to Trailer Boating in California*. It also covers nearby parts of Arizona and Nevada and provides pictures and personal notes on 500 ramps and launching sites. It has phone numbers, fees, and even tells if you can camp there in or alongside your boat. For \$9.25 postpaid (plus 50 cents tax if you're

a resident) from Blackburn Associates, Box 8154, La Crescenta, Calif. 91214, the directory is an example of what every state should have.

### Outdoor aid

Some guides can be packed along, some should be read beforehand, and a few like *The Outdoorsman's Emergency Manual*, from Winchester Press, probably deserves both. This one covers not only the classic survival problems but also what to do if you're just a little lost, or you trip

and stub your toe. Hunting, fishing, boating, camping and RV problems are all well covered. Weather, food, water, fire, shelter and first-aid for yourself and your dog are also handled. Many reminders here are useful for experienced outdoorsmen as well as beginners—latest Coast Guard figures show the average pleasure boatman in a collision or aground is between 26 and 50 and has had over 500 hours of water experience. More learning won't hurt any sportsman. ★ ★ ★

## New for All Outdoors



**Purified water** anywhere is promise of a new insulated jug with built-in filter in cap. Puri-Jug, \$40, is by Water Pollution Control Systems.



**Cease Fire** is name of a new rifle lock from Michaels of Oregon in Portland. The \$9.95 invention makes safe any two-tang bolt-action gun.



**Rapid fire with accuracy** is claim for new Minuteman air rifle Mark I 25-shot automatic from Precise, 3 Chestnut St., Suffern, N.Y.



**For finding fish at temperature levels they like best, a \$15 trolling aid called Thermalfinder is available from Aquaponics Industries.**



**Getting new grip** on a rod is easy with an add-on customizing pistol grip fitting most bait-cast blanks. Made by Berkley, Spirit Lake, Iowa.



# The Delco Freedom Battery vs. conventional batteries.

The truth of the matter is — you can't compare the Delco Freedom Battery with a conventional battery. Both will start your car. But beyond that it's like comparing apples to oranges.

## Comparison Chart.



## There is no comparison.

Up until now ordinary batteries supplied you with power to start your engine and run your accessories. But you had to *think* about your battery.

You had to remember to check the fluid levels periodically, add water when necessary. And sometimes you'd have to check the charge with a hydrometer.

Now you've got Freedom.

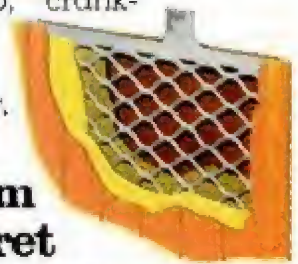
## The time and attention gap.

Look, ma, no filler caps. Delco sealed the top. So you never have to add water — no more hydrometer no more distilled water, no more remembering.

You'll probably never have to check it for the entire life of the battery.

With Freedom you'll have a powerful new way to go. In fact, you'll be reminded each time you start your car.

"Starting kick," "wallop," "cranking power," whatever you want to call it — that's what you buy a battery for. And Freedom's got it.



## The Lead-Calcium Grid...the secret of Freedom's power.

Thanks to the Lead-Calcium Grid. This feature is the key to Freedom's technological advances. It allows Delco to seal the top. It packs the power. And makes Freedom a whole new battery idea.

Here's how it works. A new lead-calcium alloy replaces the lead-antimony found in conventional batteries. Then Delco formed it in a tough corrosion-resistant grid instead of the usual cast grid.

That helps produce pure cranking guts for tough start situations.

If you want a powerful battery you can forget, think of Freedom.



**Go  
with the names  
you know.**



AC-DELCO DIVISION OF GENERAL MOTORS CORPORATION

Copyright © 1985 General Motors Corporation



**IF HE DOESN'T MAKE IT BY 35,**





# CHANCES ARE HE NEVER WILL.

Like him, you're young. And you want the good life.

But if you think you've got lots of time to get around to it, you're only kidding yourself.

The longer you knock around in dead-end jobs, the more you think that's all you're good for. You get used to being treated like a nobody. And you're so busy trying to take care of a wife and a kid and a mountain of bills, you never think about the hole you're digging for yourself.

Then one morning you wake up and realize you're over 35. Half your life is over and you're still going nowhere. With no real skill. No training. And nothing to look forward to but 30 more years of a job you hate.

It doesn't have to be this way. Millions of men and women have made it early in life. Millions of men and women actually like their jobs, because their work challenges them, they earn a decent wage, and they feel they have a future.

These are trained men and women. And you could be one, too. That's where we come in. We're ICS, International Correspondence Schools. We specialize in training for skilled careers. Like Electrician. Auto Mechanics. Air Conditioning. Engineering. Accounting. TV Repair and Servicing. Business Management. Electronics. Drafting.

## Ideal Way to Learn

It's not all fun and games. You may have to give up a few TV programs. Or a few nights on the town. But you can do it all in your own home. Without the hassle of a classroom. And without missing a paycheck.

You get the texts and equipment it takes. You get all the personalized help you need. If you want to talk to an instructor about your

lessons, you can call us from anywhere in the continental United States, toll-free, using our Dial-a-Question® service.

You could even earn a degree at home. The ICS Center for Degree Studies is authorized by the Pennsylvania Department of Education to grant the Associate in Specialized Business degree in Accounting and Business Management, and the Associate in Specialized Technology degree in Civil, Mechanical, Chemical, and Electrical Engineering Technology.

These degree programs are not mere stepping-stones to higher education nor are they primarily intended for transfer toward more advanced degrees. They are practical, career-oriented programs designed to help you reach your objectives without further academic training.

Of course, we're not guaranteeing you a job—no school can do that. But we can give you the practical training you need.

Since 1890, millions of men and women around the world have turned to ICS. And more than 70 of America's largest 100 corporations (including Union Carbide, Bethlehem Steel, 3M, International Paper) use ICS training for their own employees.

## Free Demonstration Lesson

No one can promise success, but if you *want* more—more money, more security, more day-to-day satisfaction, and more future—our free Career Booklet and free Demonstration Lesson can help you get started in the right direction. Just check the box next to the field that interests you most and mail the postpaid card or coupon today. There's no obligation. Remember, you've only got one life. Make the most of it.

X

## ICS International Correspondence Schools, Scranton, Pa. 18515

Please mail me the Free Career Booklet and Free Demonstration Lesson for the field I have checked below. I understand I am under no obligation.

- ☐ Electrician
- ☐ Engineering
- ☐ Accounting
- ☐ Drafting
- ☐ Electronics Technician
- ☐ TV Service and Repair
- ☐ Surveying and Mapping
- ☐ Construction Electrician
- ☐ Diesel Mechanic

- ☐ Air Conditioning and Refrig.
- ☐ Automotive Mechanics
- ☐ Business Management
- ☐ Civil Engineering
- ☐ Interior Decorating
- ☐ Income Tax
- ☐ Motel/Restaurant Management
- ☐ Appliance Service & Repair
- ☐ High School

- ICS Center for Degree Studies  
Associate in Specialized Business  
degree in:
- ☐ Accounting
  - ☐ Business Management
- Associate in Specialized Technology  
degree in Engineering Technologies:
- ☐ Civil
  - ☐ Electrical
  - ☐ Mechanical
  - ☐ Chemical

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Telephone \_\_\_\_\_

**Veterans:** Taken for career purposes, ICS Programs qualify for VA benefits.

Canadian residents use Scranton, Pa. address for service from ICS Canadian, Ltd. In Hawaii: 931 University Ave., Honolulu, Hawaii 96814.

XA902X



# IMPORTS AND MOTORSPORTS



## Five-door wagonback

Here's the first of the '77 models from abroad—Saab's new version of the 99. The Swedish automaker's super-practical hatchback was introduced in Europe earlier this year and will be here soon. Regarding the styling of the five-door, all I can say is, if you can live with the lines, you'll love it. It's always been that way with Saabs, and I guess it always will be.

It takes a turn behind the wheel to realize that this, as with the other 99 models with which it shares mechanicals, is indeed a car whose beauty is in the driving. It's all put together nicely and it's a lot quicker than you'd imagine: The two-liter, ohc Four is fuel-injected and needs no catalytic converter. Power's to the front wheels, of course—Saab has always done it that way (see PM next month for a feature on front-wheel drive and more on Saab).

## Five-cylinder Audi

First came the diesel Mercedes 300D—five cylinders worth. Now Audi has a five-cylinder powerplant in a gasoline version. The 2.2-liter, ohc Five powers a new Audi 100—a replacement car for the 100 LS. The new model, looking much like a Mercedes, was just introduced in Europe, and my guess is that we'll see it here to replace the 100 LS by mid-1977 as a 1978 model. More info to come on this one.

Meanwhile, at Volkswagen of America, here's what's new for '77: Audi Fox gets new sheet metal and will be more distinguishable from the VW Dasher; Rabbit and Scirocco

get CIS fuel injection and many more refinements; other models—Beetle and Beetle convertible, Dasher and the bus—are little changed.

We'll have more on the '77s from other makers as they're introduced.

## Mopeds inroads

PM was already on press with our August story on mopeds—*Mopeds: Pedal Home If You Run Out of Gas!*—when two more states opened up their roads to motorized bicycles. They are Florida and New York. That brings the total to 20 states (as we go to press!).

New York's rules are toughest: You have to be at least 15 years old, take a rules-of-the-road test (unless you're older and have a valid operator's license), pay a \$5 registration fee, wear a helmet and obey any restrictions put on these "limited-use vehicles" by the commissioner of motor vehicles. Much red tape, yet easier than registering a motorcycle.

## Setting the pace

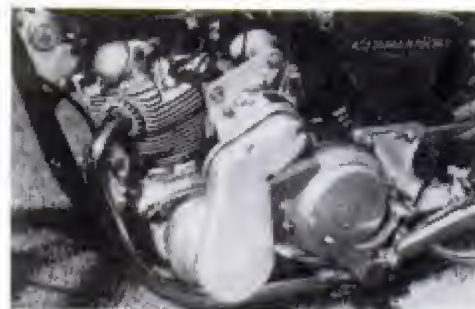
Amos Johnson got his Pacer all sorted out and set a new track record for International Motor Sports Assn. (IMSA) RS series cars. In winning the 100-mile event at Talladega, he averaged 98.76 mph on the road course. The Pacer's good aerodynamics gave him an edge on second-place



finisher Gene Felton in a Gremlin—also powered by AMC's 232-cu.-in. Six. Lots of good racing in these "bodied" cars: Three abreast into the turns isn't as dangerous as it would be in open-wheel racers!

## Supercharger for big bikes

The sidekick on the Norton 750 below is a supercharger that multiplies stock horsepower by at least a factor of two. It's available for Honda 750, H-D Sportster and Superglide, Kawasaki 900 and Norton 750 and 850. For an information packet, write Drouin Engineering, Box 124, Bissell Station, South Windsor, Conn. 06074, and include \$1, or call them at (203) 528-3571 and they'll send it free.



## High cost of auto insurance

Did you know that it's the people who don't wear seatbelts—and I'm sure you know many friends and relatives who don't—who are driving up your auto insurance rates? Reasons for the increases (my annual premium just doubled) are many and complex, but a big factor is medical payments—payments that would be a lot less if severity and frequency of injuries were minimized—and that's effectively done by wearing belts.

With my auto insurance renewal, I got a pamphlet on *What You Can Do to Help Keep Insurance Costs Down*. Top on the list from this major insurance company was "always use your safety belts." The next three recommendations were obey the speed limit, lock your car and report accidents or losses immediately. Most people observe these three, but the first? I hope this reaches those who value their pocketbooks, if not their lives—maybe my rates won't go up next year. ★★



OIL  
TREATMENT

\* MARCA  
REGISTRADA

FOR  
MOTORCYCLES

## DIRECTIONS

**CRANKCASE**—First time you need oil and every time you change oil, add **STP** Oil Treatment to your engine when it is running and warmed up. New and low mileage cars use one can **STP** to 4 or 5 U.S. quarts of oil (or 10% **STP** when oil capacity is below 4 or exceeds 5 quarts.) Engines with excessive wear, use **STP** up to 20% of oil capacity. **MANUAL TRANSMISSIONS, GEAR**

**BOXES AND DIFFERENTIALS**—Add 10% **STP** Oil Treatment to motor oil before use. **POWER STEERING**—Add 10% **STP** Oil Treatment to power steering fluid before use. **LUBRICATED PARTS**—Add 10% **STP** Oil Treatment to all lubricated parts before use. **STP** Oil Treatment is available in 15 oz. cans and 1 quart bottles.

SQUEEZE MOUNT  
TO FORM POURING

— 15 OZ. LEVEL

# If you want to help reduce engine wear and oil consumption, follow the simple directions.

Use STP Oil Treatment at every oil change and the first time you need oil and you'll be taking a helpful step toward reducing engine wear and oil consumption in your car. STP's effectiveness was confirmed in a series of tests conducted by Automotive Research Associates, Inc. in 27 cars driven over half a million miles. In those tests it was clearly

shown that STP Oil Treatment helps reduce engine wear, and oil consumption, too. That's because STP fortifies and toughens oil... even a premium 10W-40 to help reduce the wear rate of lubricated parts in an automobile engine.

And if you'd like to know what's in STP Oil Treatment and how it works you can read about it, plus detailed

test results, in a free booklet available from STP\*. But while that takes four pages to explain, the directions are simple enough to fit on the side of the can. And if you want the security of knowing that you're helping your engine live a longer life, that's the next thing you really ought to read.

\*For your free booklet, write to: STP Corp., 1400 W. Commercial Blvd., Ft. Lauderdale, Fla. 33330.





**Introducing a new symbol of driving excitement.  
The 1977 Cougar XR-7 unleashes 6 new running mates**







The leader of the pack with new action for the Cat Set—Mercury Cougar XR-7. Bold. Aggressive. New. From the dramatic new symbol on its hood to the tip of its sleek rear deck. More of a Cougar than we've ever unleashed before.

Inside, you'll find the luxury standards that put this cat in a class by itself. Deeply padded flight bench seats. Walnut wood-trim instrument panel. Select-shift automatic transmission. Power brakes. And steel-belted radials. All at no extra cost.

And now there's even more Cougar excitement. Because now there's a whole new breed of Cougar running mates.

## 2 New Sedans 2 New Hardtops

All Cougar. All the way. These cats deliver new comfort and convenience with Cougar's own brand of driving excitement.

Select-shift automatic transmission. Power steering. Power brakes. And under the hood, the purr of a 302-2V engine.

All standard on all new Cougars.

Take the wheel of any Mercury Cougar—whether it's a 2-door or 4-door—and you take command of the road.

## 2 New Wagons

Now sporty new wagons that pack a lot of excitement: Cougar wagons. Everything you want a wagon for—plus. A 351-2V engine. 3-way tailgate. And Cougar's own standard of standard equipment. There's never been a wagon like it. Because there's never been a Cougar like it.

2 new wagons. 2 new hardtops. 2 new sedans. And the new Cougar XR-7. Off the leash and ready to run. New action for the Cat Set at the Sign of the Cat.

# MERCURY COUGAR

LINCOLN-MERCURY DIVISION





# APPLIANCE CLINIC

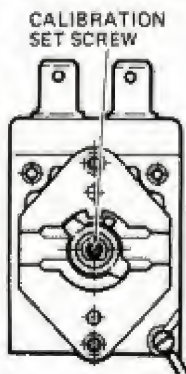
BY PAUL MANN



## Some like it hot

*The oven section of our Kenmore electric continuous-cleaning drop-in range (450 series) doesn't seem to get hot enough. My wife has followed the advice given in the owner's guide, but still it takes an extraordinarily long time for cooking. Please advise.—John Eden, Omaha.*

The first step, John, is to check the oven temperature with a mercury thermometer to determine if your suspicions are valid. Place the thermometer in the center of the oven and turn the thermostat control knob to 375°. Allow enough time for the temperature to stabilize. Then read the thermometer. If the temperature is between 365° and 390°, the calibration is correct, and you'll just have to have some patience. However, if the temperature is, as you suspect, below 365°, recalibrate the thermostat.



To do this, disconnect the range from current at the fuse or circuit breaker box. Raise the main top and remove the switch cover plate, which is held by two screws. This permits you to reach the thermostat's calibration setscrew (see illustration).

Turning the screw  $\frac{1}{4}$  turn in a counterclockwise rotation will raise the temperature by about 25°. Determine that the proper calibration adjustment has been made by turning on the electricity and setting the thermostat at its maximum position. See that the oven door is closed. The thermostat must cycle when the maximum temperature is reached. If it doesn't, turn off the electricity, let oven cool and replace thermostat.

## A penny here, a penny there

*If I disconnect my electric water heater in the morning when I go to work and turn it on when I return, how much money do you think I would save?—William Carr, West Palm Beach, Fla.*

You can figure it out yourself, but remember that calculations are approximate. There are variables

which preclude exact dollar amounts. One, for example, is the fact that although it's connected, a water heater does not operate continuously.

First determine the appliance's wattage by consulting the specification plate attached to the unit or by looking in the operating manual. Convert watts to kilowatts by dividing watts by 1000. Calculate the amount of time the appliance will be out of use each day in terms of hours and fractions of hours. In other words, 10 minutes would be .166 hour, 15 minutes would be .25 hour, 20 minutes, .333 hour, and so forth.

Now multiply kilowatts by the number of hours and fractions to obtain kilowatt hours. Once you have that, apply kilowatt hours to the kilowatt hour charge you pay the electric company. The result will be your approximate daily saving. Now multiply this by the days in the year that the heater is likely to be off to find your annual saving (allow for weekends, vacations and other times you may be home).

Based on a national cost per kilowatt hour of 3 cents and an average annual in-use time of 4811 kilowatt hours, the Electric Energy Assn. estimates that the average annual cost of operating an electric water heater is \$145. Any amount you save is, of course, to the good, but only you can tell whether it's worthwhile.

## A reply from Maytag

*We at Maytag agree with your comments concerning sluggish automatic washer agitation if the washer has been installed in a nonheated area ("Stiff in the Joints," Appliance Clinic, July '76). Lubrication will thicken as the temperature drops.*

*We would however, not normally expect lubrication to reach a point where it would slow down the agitation speed until the temperature dropped into the mid-40s or lower. I would be surprised to see this condition in the southern Florida area where Mr. Batson resides.*

*Thickening of the power unit lubricant can also be the result of oxidation of the lubricant. This could be due to moisture which causes a breaking down of the oil. If this is the case, the lubricant will*

*probably continue to thicken to the point where the lubricant will require replacement.*

*Although it is true that we used the same lubricant for many years with excellent results, we did change lubrication in January, 1975. This new lubricant contains additives to minimize oxidation and thickening of the lubricant. We also made a revision in 1972 which added an "O" ring seal between the collar of the agitator shaft and the upper bushing in the center assembly. I have no idea as to the age of Batson's washer, but feel that the new lubricant along with the addition of the "O" ring seal should overcome the problem of oxidation and thickening of the transmission lubricant.—J.C. Austad, Manager of Product Service, Maytag Co.*

Those who own Maytag washers which seem to have sluggish agitation action will benefit from Mr. Austad's remarks and also from the article concerning Mr. Batson's problem which appeared in *Appliance Clinic* (June, '76, page 22).

## A penny saved . . .

*I recently purchased a frost-free refrigerator for a summer cottage. There is discussion as to whether it's a good idea to unplug it when it's not being used for a few months. Your advice will be followed.—Jack Schmeling, Milwaukee, Wis.*

As long as you aren't keeping food in the unit, I'd suggest that it be unplugged. Other suggestions:

First, empty ice cube trays or bins and disconnect an automatic ice maker. Second, wash the refrigerator and freezer compartments with baking soda solution and dry them with towels. Third, block open the doors to allow ventilation and prevent a buildup of odor. You can place a so-called refrigerator deodorizer that contains charcoal granules on a shelf to insure against odor. It will last about a year. ★ ★ ★

*If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N. Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.*

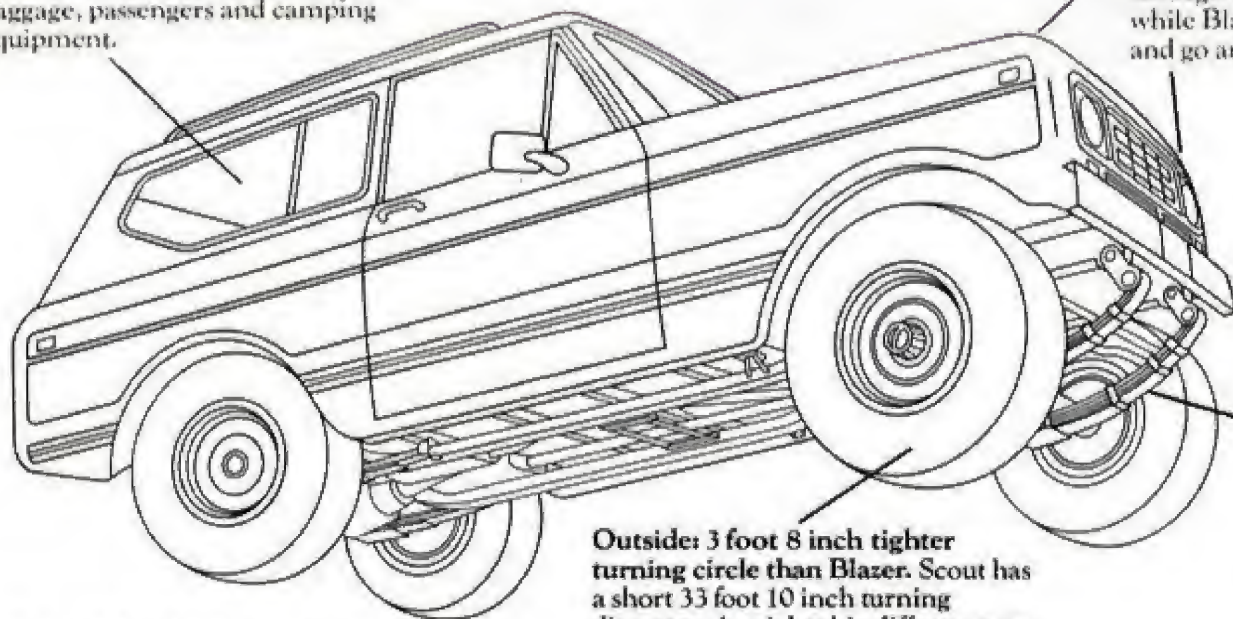


# Scout II beats Blazer. Inside and out.



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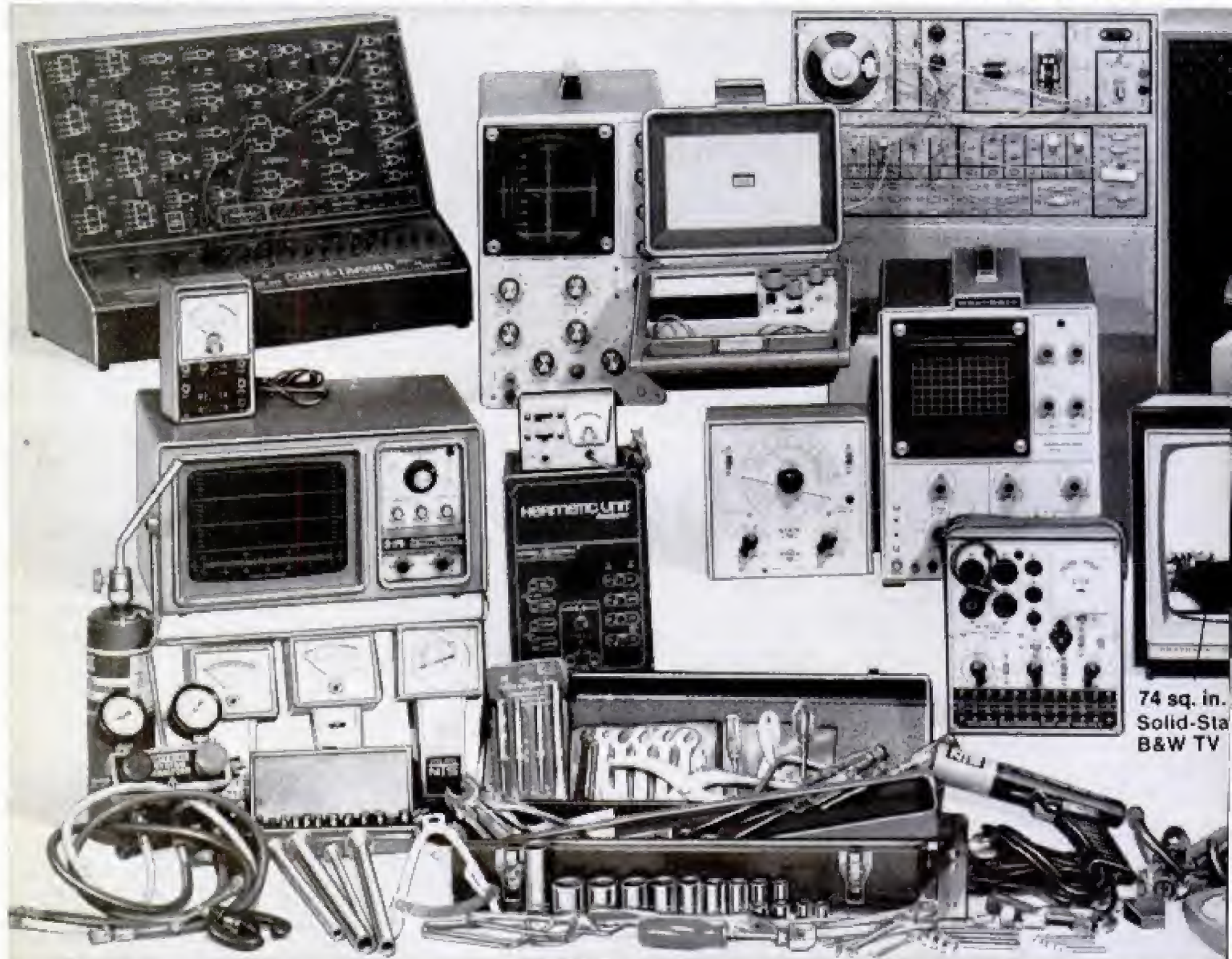


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BY EUGENE A. SLOANE

## THE BICYCLE SHOP



### Eliminating looseness

*When I reassembled my front wheel after taking it apart for cleaning and regreasing, I noticed it was loose. How do I adjust to take out this looseness?—Evan Samett, Tappan, N.Y.*

Bike wheels have threaded axles with adjustable cones. The cones have a flat washer and a locknut behind them. You need two thin cone wrenches, usually 13, 14, 15 or 16 mm. Make sure both ends of the axles have about the same length of shaft once you thread the cones, washers and locknuts back on. Tighten the locknut on one side, holding the cone with the other cone wrench. Tighten the other cone with your fingers until it starts to bind, then hold it with one cone wrench and tighten the locknut. Spin the axle between thumb and forefinger to check for tightness or roughness and push the axle up and down to check for looseness. If it's too tight, hold cone with wrench, loosen locknut with other wrench, turn cone counterclockwise  $\frac{1}{4}$  turn, tighten locknut and recheck. Tighten cone clockwise  $\frac{1}{4}$  turn if too loose. Repeat as necessary.

### How not to get stuck

*Here in Colorado we have a problem with flat tires. There's a two-spined "goat's head" cactus-type sticker thorn that's all over the place and that causes frequent flat tires. Why doesn't the bicycle industry do something about this problem?—Donald H. Cranston, Greeley, Colo.*

It has. Any bicycle shop out your way should be able to provide you with special thick "thornproof" tubes for your tires. The tubes are heavy, though, but worth the extra effort it takes to pedal with them in terms of time otherwise wasted in fixing flat tires. I would never cycle in cactus country without them.

### Gripping address

*You showed a new Williams hydraulic bicycle brake in the August, 1975 issue of PM. I have written to but have not heard from this company. Where are they located?—Daniel Carver, New York.*

Williams says they never received

your letter. Try again, to Williams Hydraulic Brakes, 2432 Delta La., Elk Grove Village, Ill. 60007. However, these brakes are not available on a replacement basis as yet. Production is committed to new bike makers. You'll find these brakes on new Sears bicycles soon. In about a year they should be available to the replacement market.

### A warm head means warm feet

*About  $\frac{1}{3}$  of the blood flow goes to the head, with a consequent great radiation of heat from the head. To conserve heat to help keep feet warm, insulate the head. In other words, if you're out in the cold, wear a warm hat. I enjoy your column a great deal.—Michael McNalley, M.D., Kirkwood, Mo*

I agree. In winter I wear a Bell motorcycle helmet. It's heavy, but it's warm and safe too. I should have remembered about keeping the head warm; any old camper knows the old trick of wearing a wool Navy "watch" cap to bed on cool nights. You can be mighty uncomfortable, even in a down-filled sleeping bag, if your head gets cold. So for warm feet, be a hot head. (In a recent issue I told a reader from Montana with cold feet there is nothing much he can do when it gets  $-20^{\circ}\text{F}$ . to keep tootsies warm. A warm head should help, though).

### A square in bike circles?

*I saw a picture of a Japanese bicycle with a square rear wheel (p. 137, Oct. '74 PM). What effect will this development have on the future of bicycling?—William Buck, Woodbury, N.J.*

I nominate this "development" as the innovation least likely to succeed in the bike business. Every year Honda has a contest to see which of its employees can come up with the zaniest transportation ideas, and this was one of them. It's clever, but not practical. ★★

*If you have any questions about bicycling send them to The Bicycle Shop, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.*



# COME RIDE THE WIND, THE FURY.

There's a new car that moves as free as the wind. It's called the Fury. The new Plymouth Fury. The Fury is excitement. As fresh and different as America today. Fury glides through curves and up steep climbs. Like the wind.

A new optional Electronic Lean Burn Engine\* gives Fury an even greater will to run smooth and free. The Fury is roomy. Inside it's like the wide open spaces. The Fury is affordable, too. With a base sticker price that makes it a breeze to own.

Come ride the wind. Ride the Fury.




## THE NEW PLYMOUTH FURY



A PRODUCT OF  
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CORPORATION

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On June 28, 1976,  
we hid a case of  
Canadian Club deep  
within a hellish hole  
in the earth called  
Death Valley.

Here's how you  
can find it:



*Even rugged Bighorns venture into the Valley with trepidation.*

The names of Death Valley are names born of despair: Furnace Creek, Lostman Springs, Coffin Canyon, Funeral Mountains. One acrid, brackish pool called Badwater is actually 280 feet below sea level—which is just another way of saying as close to Hell as a man on earth can get.

And somewhere in this desolate jumble of earthquake debris, lava flows, sand dunes and salt flats—the hottest, driest hole in the Western Hemisphere—is hidden a case of the wettest whisky in 87 lands: Canadian Club. If you're up to the adventure, you might try to find it.

**A Sober Warning:**

Please be warned before you set

out, you'll be trespassing in a world apart. A world where 120° in the shade is common. Where surface temperatures of 190° can melt the rubber soles of your shoes. And your bare hand touching a simple metal tool can mean a painful third degree burn. The fierce desert heat twists and warps reason. Even in this age of "air conditioned comfort," it remains capable of snuffing out the lives of the unwary.



*Some Valley residents have had thousands of years to adapt to its desolate conditions.*



**Your Route to the Treasure:**

Head south out of Furnace Creek. Past Badwater. Past Devil's Golf Course. Past Dante's View. South of Saratoga Springs, turn right on the road just outside the boundary of the Death Valley National





*The relentless desert sun plays tricks with the camera's eye near Furnace Creek.*

Monument. In less than a mile, you'll find an old road that leads straight up into the hills. Soon you'll come to a fork. To the left the old road continues. To the right it becomes a wash. Up that wash is a shady spot where you can rest before starting your



*The actual case of C.C. being buried 18 inches beneath the desert floor.*

final assault.

While you're sitting there, you'll notice an ancient rock through which centuries of relentless erosion have carved a natural

hole. Proceed 144 paces up the wash from that rock. Then turn toward the setting sun. Now take thirteen more paces toward that ball of fire that's been trying to drive you out of the Valley all day.

#### **Your Final Reward:**

You'll have to dig around a little to find our Canadian Club. And in Death Valley that can mean a fifth of sweat an hour. But that's why we hid a whole case. Because by the time you find it, you'll have a thirst for more than mere adventure.

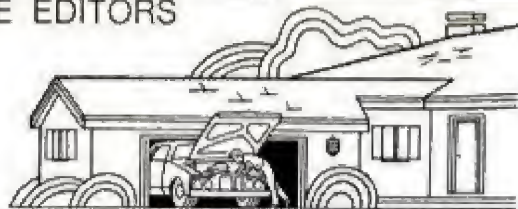
# Canadian Club

"The Best In The House" in 87 lands.





# THE PM GARAGE



## Sun for Saturday mechanics

If you've ever been lazy and taken your car to a shop for a tune-up or repair, you're certainly familiar with the name Sun. It was probably professional Sun equipment that was used in the shop. Sun electronic diagnostic and service equipment has been used in garages and service shops for the past 45 years. The company's latest super rig is known as the 2001 Diagnostic Computer which is easily recognized by its big cathode ray tubes which display tune-up data.



On a more modest scale is the new line of Sun equipment for the Saturday mechanic. Shown above is the Sun Dwell/Tachometer which is powered by the circuit being tested and needs no batteries or battery hookup. It does everything you'd expect of a good dwell/tach and the price is \$64.50.

Other gear in the line includes an inductive timing light (\$49.99), vacuum gauge (\$17.99), compression tester (\$17.99) and remote starter switch (\$7.99). All of the equipment mentioned so far is available in a carrying case that sells for \$169.99.

Most intriguing, but not available until next spring, is the combina-



tion timing light and dwell/tach which is shown above. Suggested retail will be around \$60. Sun Electric Corp., Consumer Products Div., 3011 E. Route 176, Crystal Lake, Ill. 60014. —B.H.

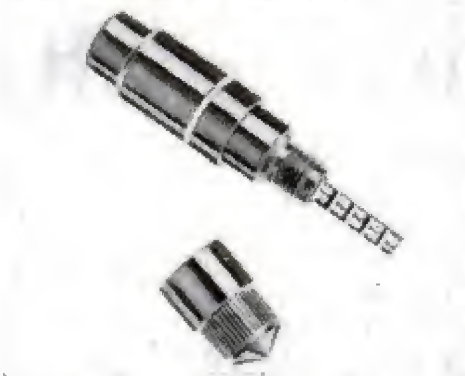
## Squeeze-action ratchet



One of the more frustrating situations in car repair is getting your socket on a bolt head and then finding that you have little or no room to loosen or tighten the part. Where there's no room, Tite-Sqez is the answer: Squeezing the handle produces the rotational movement of the socket. The box socket rotates in one way; for reverse rotation you simply turn over the wrench. You can get enough torque for most jobs with this tool, sold in kit form for \$19.95.

In the kit are 22 pieces: Sockets are standard and metric, screwdrivers are slot and Phillips, and you even get six Allen wrenches. Consumer Tool Corp., 7300 Melrose St., Buena Park, Calif., 90620. —B.H.

## Tire pressure at a glance



Continual readout of tire air pressure in p.s.i.—that sounds like computer language for a complex pressure monitoring system, but that's exactly what you get with these simple Flata-cator caps. You leave them on your tires and read the extended slide. You can add air without removing caps. Set of four, \$3.98; two for bikes, \$2.50. Serendipity Product Factors, Box 707, Sacramento, Calif. 95803. —B.H.

## Adds life and luster

From England comes a new rubber and plastic preservative called Buffy. The importer tells us it has 36 dif-

ferent chemicals in three different groups—one to preserve what it's put on, one to preserve itself, and a third to effect an electron exchange.

Buffy adds luster and prevents deterioration of plastic, vinyl, plexiglass, rubber, leather, wood and painted metal. It brings such items as station-wagon wood grain back to life, puts a glow on and prevents cracking of tires and weather-stripping.

Buffy is available in 6 and 12-ounce fingertip spray bottles at \$2.29 and \$3.89 each or in quart and gallon sizes. It's sold at auto stores, or order it directly from the importer: MP Chemicals, Box 8806, Stockton, Calif. 95208. —M.L.



## Coolant recovery made simple

A coolant recovery system has many advantages, and if your car doesn't have one as original equipment, you can retrofit one easily. The kit shown here, called Top Performer by its distributor, is \$10. Performance Products, Inc., Box 27407, Tempe, Ariz. 85282. —B.H.





# 96% OF ALL CHEVY TRUCKS REGISTERED IN THE LAST 10 YEARS ARE STILL ON THE JOB.



Chevy has an impressive record for building trucks that last. The chart shows the percentages still in use in each of the most recent model years recorded. 96% of all Chevy trucks registered during those model years were still in use on July 1, 1975, as reported by R. L. Polk & Co.



Chevy pickups are tough in the right places. With two steel walls in the Fleetside tailgate, body sides, doors, front fenders and hood. With extensive rust and corrosion protection that includes a 7-step process for cabs, immersion in electrically

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your Chevy dealer. And while you're there, take a test-drive.



**BUILT TO STAY TOUGH**



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## PHOTO HINTS

### FROM READERS

#### Labels for slides and prints



Those small, adhesive-backed return-address labels sold by many mail-order companies for about \$1 per thousand are the perfect way of identifying 35-mm slides sent out to a lab for printing slides sold for one-time publication, or slides just borrowed by family or friends that you want back. They're also handy for identifying prints made on RC papers, which are difficult to write on.

—Mark Fineman

#### Informative jug labels



How long has that developer been sitting around? How much paper have you run through that fixer? Attach four photo-mounting corners to your container and insert a file card on which you can write down that information as a reminder. When the card is full, insert a new one. The old-fashioned "lick 'em" type of corners work better than the self-stick ones.—F. O. Walsh



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## NEW

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## NEW

IM Distortion Analyzer — true professional performance at a low kit price.

## NEW

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Variety is the spice of the kitbuilder's life. And this year Heath has more kits than ever for you to choose. Kits for gifts and kits for yourself. Kits for grown-ups and kits for kids. Kits for amateurs and kits for professionals. Easy to build and efficient kits. Creative kits. High-value kits. Sophisticated and simple kits. Kits for every interest. For TV watching and playing. For music listening and music making. For learning and experimenting. For homemaking and shop-building. Kits for drivers and flyers. For boaters and fishers. To control model planes and trains. To watch the time and weather. Kits for talking and listening. They're all in the Heathkit Fall catalog.

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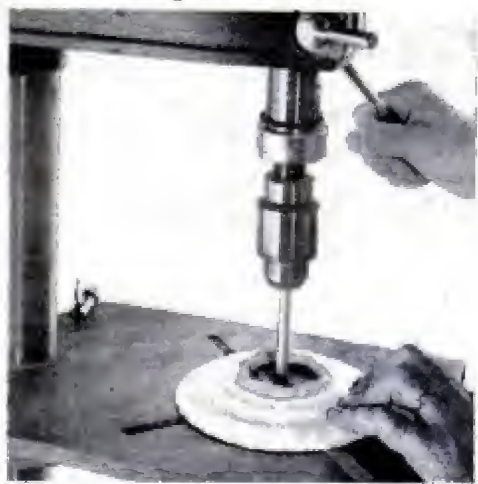


*White Burley Blend. Pleasingly Aromatic.*

## HINTS

### FROM READERS

#### How to drill glass or china



Drilling glass or china is easy if done on a drill press. The drill is a piece of brass tubing having an outside diameter equal to the size hole to be drilled and a slot cut in one wall with a hacksaw blade. Make the slot about 1/4 in. deep. The tube is not sharpened in any way; the end is simply cut square and then slotted or notched.

The glass should be supported on a perfectly flat piece of wood, or better on felt or rubber. A dam of putty is formed around the place where the hole is to be drilled to create a well. The well is filled with a mixture of 80-grit silicone-carbide abrasive grits combined with machine oil or turpentine. The drill press is operated at its slowest speed and the tube pressed gently against the glass. Raise it slightly at frequent intervals during the drilling to permit the compound to flow into the groove as the hole is cut. It's the abrasive, not the tube, which does the actual cutting. A few minutes of light pressure will produce a clean, smooth hole.—Rick O'Shea

#### Carpet-scrap polisher



A scrap piece of short-pile carpet tacked to a wooden base and given an application of household cleaning powder makes a handy polishing pad for the shop. The item to be shined can be rubbed over the carpet surface.—Walter E. Burton

## No-nail, no-screw, no-clamp cement.

Like to install a towel bar? A kitchen fixture? Spread a little Elmer's® Heavy Grip® on both surfaces, let dry a minute—and contact. The bond actually gets stronger with time. For all kinds of adhesives, you know you can trust Elmer's.

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The Searcher is tunable. You don't have to buy or change crystals for each public service channel as with the conventional scanner. Let's say you want to

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MODEL 7-2985

**MOBILE 1.** This compact model gives you the same full Public Service VHF (hi) spectrum as the Searcher. We've taken out the AM/FM and made it smaller, for real hand-held portability at a lower price.

GENERAL  ELECTRIC



# "Ford-built. It's a lot that are good-built."

This is a starter drive that Ford built. It comes on every Ford, Mercury and Lincoln that Ford builds. Instead of 4 cams, a Ford Motor Company starter drive

has 5 cams.

So, it should last 50% longer.

These are the starter drives that start the cars that Ford built.





# of things

This is a solid state ignition that comes on the cars that Ford built.

Solid state ignition means no more points... no more condensers.

You get a stronger spark for better starting.

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# PM's guide to cassette tapes

How 32 major labels compare.

by Craig Stark

**C**onfused about which blank cassettes will give you the highest fidelity? That's no surprise: New tape types keep proliferating, and manufacturers rarely adopt others' developments without giving them new names. And the tape that works best on one machine may not work best on another.

But underneath the labels, tapes fall into basic groupings. The trick is first to find out which tapes belong to which group; second to learn which group is best for your recorder; third to find out which tape in that group is best for you.

Tape oxides aren't necessarily products of long research at each tape company's lab: With the major exception of 3M, most tapemakers here and abroad buy their oxides by catalog number from American chemical companies.

But there are differences between oxides and between the binders that hold those oxides to the tape. Tape makers do find their own, proprietary answers there.

## Four types of oxide

Four types of oxide—chromium dioxide, ferric, cobalt-doped and ferrichrome—account for all the tapes now made.

*Chromium dioxide* ( $\text{CrO}_2$ ) was the tape that changed the world's opin-

ion that cassettes could never be free enough from hiss or summon enough high-frequency response to be considered high fidelity.  $\text{CrO}_2$  had enough treble energy available to overcome those problems—and enough left over to require changes in recorders to avoid shrillness (and also to avoid distortion).

Those changes involved the addition of the now-familiar "bias" and "equalization" switches to recorders. For with the settings designed for ferric (iron) oxide tapes,  $\text{CrO}_2$  would show the decreased sensitivity and rising treble of the "underbiased" curve (see graph below) instead of a flat response like the "correctly biased" curve. But a machine adjusted only for  $\text{CrO}_2$  would sound poor with ordinary tapes: Its response would droop like that of the "overbiased" curve.

## Can't standardize

Why not just standardize on chrome tape? For one thing, because recorder owners might want to reuse their older, ferric tapes. But also, chrome does have slightly higher distortion and slightly less low-frequency output than the best of the iron, and it originally cost much more than iron oxide. There are myths about  $\text{CrO}_2$ , also: that it will wear out your tape heads (ignore that one); that it can't be evenly dispersed on the tape (ignore that, too); and that its characteristics vary widely from batch to batch (maybe—but all manufacturers assure me *theirs* are all preselected, good batches. And they're as consistent in my tests as the ferric oxides are.)

*Ferric oxide* makers have responded to the challenge of  $\text{CrO}_2$  with better and better oxides which match or surpass chrome's high end performance using "normal" bias and equalization. I put that word in

quotes because there are actually two ferric-oxide norms: the DIN standard bias and equalization used for American and European tapes, and a slightly higher bias (about 5 percent) used for most Japanese ones.

That's why some tape decks have *three* bias settings: one for "ferric low" or "standard" (DIN) bias; one for "ferric high" (Japanese) bias; and one for chrome. When each tape is used with its proper bias, the Japanese tapes average marginally better performance than the DIN ones—about one or two dB better high-frequency response, on the average for top-line tapes. When biases are mismatched, both types suffer: Japanese tapes turn slightly sharp, with about one or two dB too much treble and a bit higher distortion, when used with DIN bias; DIN tapes develop a droop of a couple of dB or so in their high end when Japanese bias is used.

*Cobalt-doped ferric oxides* have also been tried, adding cobalt to the iron to yield higher output (better signal-to-noise ratio), less distortion, and a significantly hotter high end. The chart on page 48 shows how well these tapes perform—but note that they require the Japanese "high" bias.

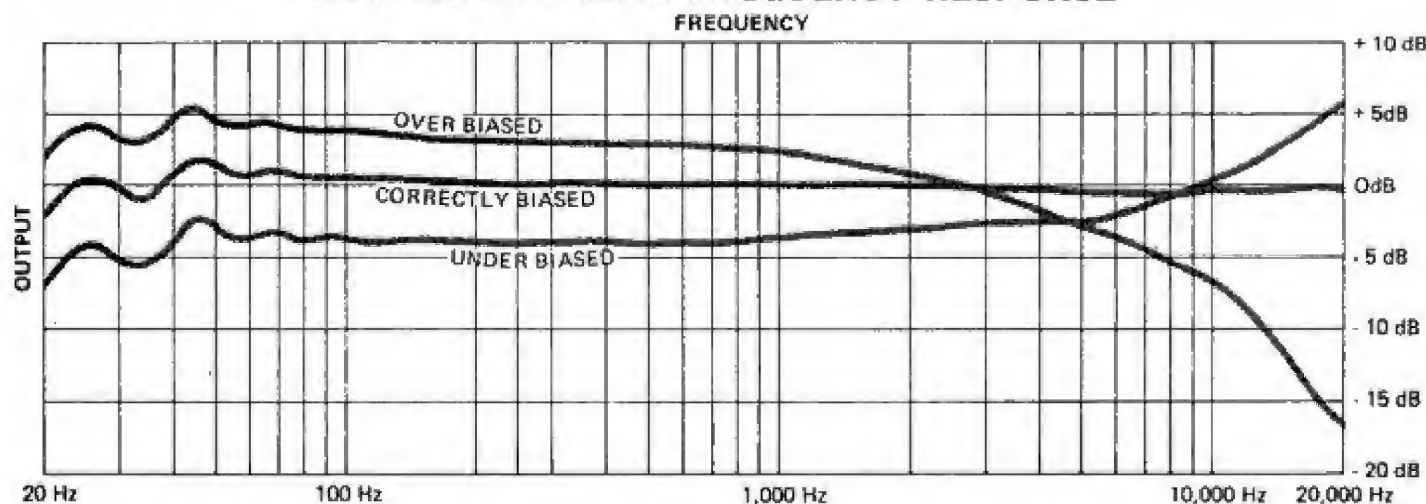
*Ferrichrome* is a two-layer oxide coating with a thick, ferric base to match the tape to conventional bias and equalization, plus a thin  $\text{CrO}_2$  top coat to supply treble sparkle. The trouble is that, on most machines, these tapes show an anomalous dip in their middle high-frequency response (about 5 kHz), which other testers have encountered, too.

## More switch positions

This dip doesn't show up on all recorders, but it's suggestive that its existence is one reason that a num-

(Please turn to page 48)

## HOW BIAS AFFECTS FREQUENCY RESPONSE





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ber of decks now have extra equalization switch positions marked for "ferrichrome." And it raises the spectre of the need for four-position bias and equalization switches (for DIN ferric, Japanese ferric, CrO<sub>2</sub> and ferrichrome); and by the time that comes true, *nobody* will be able to keep straight which tape type goes with which switch settings. To counter this, the industry is hard at work to devise a tape rating system which will simplify these adjustments.

For a while now, many ferric tapes have been able to match CrO<sub>2</sub>'s high end, achieving flat frequency response throughout the audible spectrum—but they've done it with the aid of a bit more treble boost in playback, which also makes tape hiss more audible. Very recently, how-

ever, two new cobalt-treated ferric oxides—TDK Super Avilyn and Nakamichi SX—have closed the circle completely, with a third, Maxell UD-XI-II due by the time you read this. These new tapes—which use the *chrome* switch position on your tape deck—give an audible improvement in signal-to-hiss ratio, but their distortion is not quite as incredibly low as that of the best ferric-setting iron oxides.

Far down the pike, however, are a whole new breed of magnetic materials—not oxides, but pure metallic particles that can improve performance by 12 dB—if they can lick two problems: This tape requires enough bias to overheat today's tape heads; and when exposed to air, it self-combusts. A hot tape, indeed. ★★

## HOW 32 TAPES COMPARE

Standard (DIN) Bias and Equalization	Frequency Response	400 Hz. Output for 0 VU Input (dB)	Maximum Output Level (dB)	Maximum 10 kHz Output (dB)	Weighted Signal-to- Noise Ratio (dB)
DIN standard blank cassette	B	±0.0	+4.9	-6.3	56.6
Ampex 20/20+	A	+0.6	+5.0	-5.8	56.3
Ampex 370 Low Noise/High Output	D	-1.7	+0.5	-10.8	51.1
BASF Studio Series	B	-0.5*	+4.1	-7.9	56.4
BASF Performance Series	C	-0.8*	+2.1*	-7.4	53.5*
Capitol, The Music Tape	C	+2.3	+6.9	-6.1	58.5
Capitol 1	D	-0.5*	+1.7*	-13.0	52.5*
Maxell LN	C	-0.9	+1.2	-8.1	52.4
Memorex MRX2	A	+1.0	+4.4	-5.1	56.1
Scotch Classic (ferrichrome)	†	+1.0	+3.3	-5.9	55.7
Scotch Master	A	+1.0	+3.6	-3.3	55.3
Scotch Low Noise/High Density	D	+0.6*	+3.4	-9.2	55.2
Scotch Highlander	D	-1.0	+1.8	-9.9	53.5
TDK SD	C	+1.0	+4.7	-6.6	56.0
TDK D	C	+0.7	+3.7	-7.2	54.2
<b>High (Japanese) Bias and Equalization</b>					
Fuji FX	A	+0.6	+4.9*	-3.8	54.9*
Fuji FL	C	-1.1	+1.4	-6.8	52.6
Maxell UD	A	-0.5	+2.7	-5.4	52.8
Maxell UD-XL	A	+1.8	+6.7	-4.7	57.6
Nakamichi EX	A	-0.6	+2.9	-5.0	53.1
Nakamichi SX	A	+1.8	+6.6	-4.4	57.4
Sony FeCR (ferrichrome)	†	-0.1*	+2.9*	-3.1	54.7*
Sony UHF	C	+0.3	+4.6	-6.4	56.0
Sony Low Noise	D	-1.4	+1.5	-9.2	53.2
TDK Audua	A	-0.4	+2.1	-3.9	51.7
<b>Chromium Dioxide Bias and Equalization</b>					
BASF Chromium Dioxide	B	-0.8	+0.8	-7.7	56.0
Capitol Music Tape CrO <sub>2</sub>	A	+0.6	+3.3	-6.4	57.4
Fuji FC	A	-0.4	+1.6	-7.0*	56.2
Memorex Chromium Dioxide	A	-1.6	-0.6	-7.6	53.7
Scotch Chrome	B	-0.3	+1.9	-7.4*	58.6
Sony CRO	A†	-0.5	+1.6	-4.9	56.9
Nakamichi SX (ferric)	B	+2.5	+5.1	-5.8	59.5
TDK SA (ferric)	B	+2.3	+5.2	-5.4	59.7

\*Indicates sample-to-sample variations of more than ±0.5 dB. †Dip in midrange response (see text). ‡Gradually rising treble response above 5 kHz, reaching +3.9 dB at 19 kHz.

## Interpreting the tests

I tested several samples of each of 32 "major name" C-60 cassettes on a Nakamichi 1000 deck. The results are in the table (below, left), but here's how to interpret them:

**1. Frequency response:** Except as noted, machine-run frequency response curves fell into four families.

A +0.5, -1.0 dB, 100-20 kHz

B +0.5, -2.5 dB, 100-20 kHz

C +0.5, -4.0 dB, 100-20 kHz

D ±1.0, 100-2 kHz; -5 to -10 dB at 15 kHz

Below 100 kHz, all the tapes performed essentially alike. I've specified frequency response by group because differences within each group would be inaudible. In fact differences between Group A and Group B could only be measured on extremely high-quality equipment; and while the high-frequency losses in Group C might be audible in a direct comparison with Group A or B tapes, few listeners would notice them under less severe conditions.

**2. Output:** This shows the output of each tape in decibels relative to the output of a DIN standard blank cassette, when each was recorded with an identical 400-Hz. tone at "0 VU" level. All else being equal, the higher the output, the better. Fraction-of-a-dB differences aren't too important.

**3. Maximum output level:** This is the maximum mid-frequency output available from each tape before its harmonic distortion level exceeds 3 percent. This is the "signal" part of the tape's signal-to-noise ratio. Again, the higher the better.

**"Headroom"**—the safety allowance for peaks between the normal "0 VU" maximum recording level and the onset of serious distortion—equals the difference between columns 2 and 3; so the bigger this difference, the better, too.

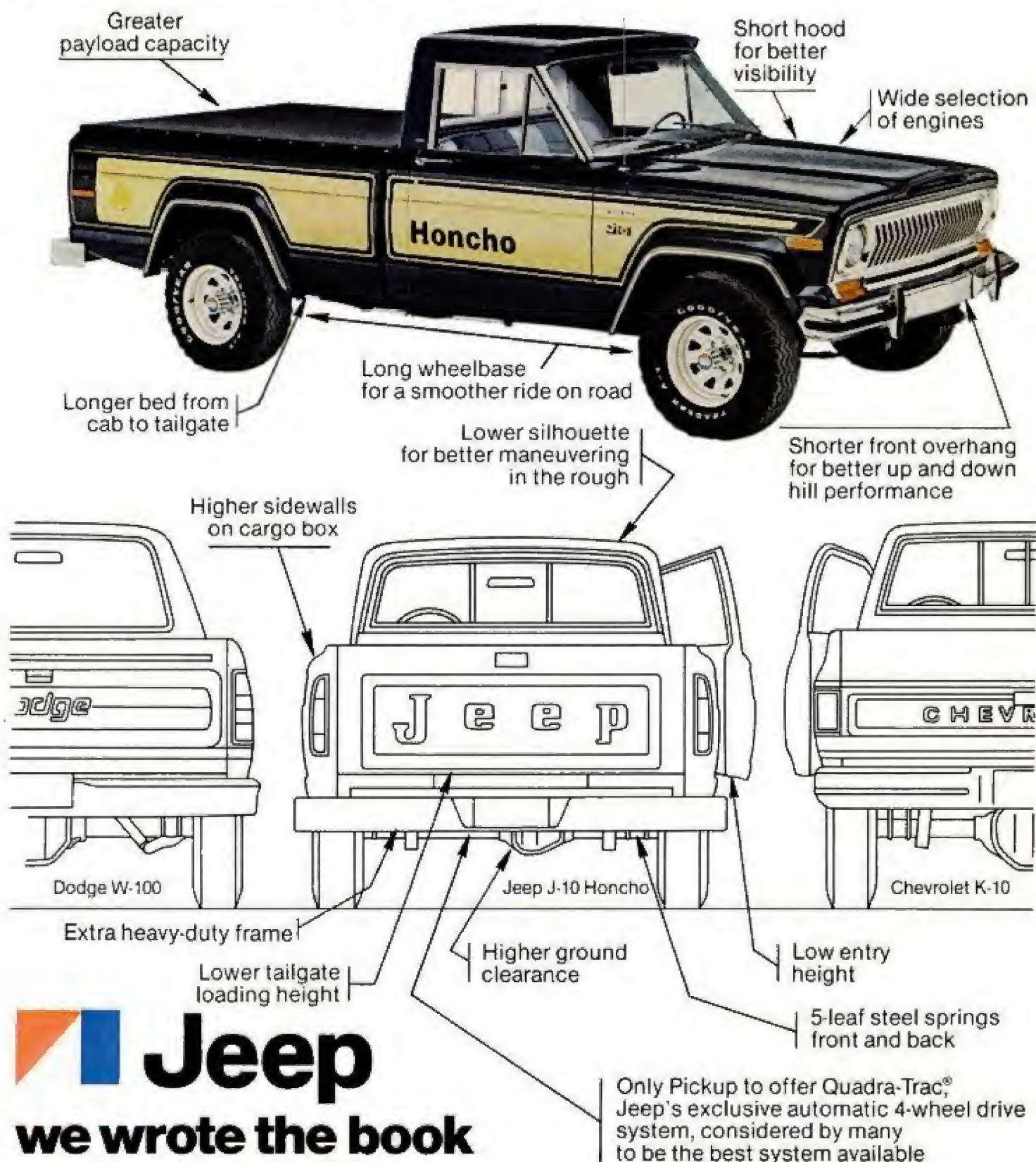
**4. Maximum 10-kHz output:** Feed a tape a stronger signal and you get a stronger output—up to a point where the tape "saturates." Beyond that, at low frequencies, output stays the same no matter how much signal you pour in. At high frequency, adding signal actually decreases output.

No tape can produce a full "0 VU" output at 10 kHz, but the closer a tape comes to zero, the more resistant to high-frequency saturation it is. So the smaller the negative number (and the closer to zero), the better. Usually, this property is represented by a series of frequency response curves taken at increasing levels; my approach gives a unique figure of merit for each tape.

**5. Weighted signal-to-noise ratio:** This is the difference, in dB, between each tape's 0 VU signal output (column 2) and the minimum noise produced by the recorder's bias current. This measurement was made through an NAB "weighting" filter to approximate the ear's sensitivity to background noise, C.S.



# Jeep Pickup puts down the facts... (and the competition)



Jeep Corporation, a subsidiary of American Motors Corporation

Advertisement for the 1987 Jeep J-10 Honcho pickup truck.



# CAR CLINIC

BY MORT SCHULTZ



## Orchestrated gauges

*I have the darndest problem with the instruments in my 1966 Ford. Fuel, temperature and oil pressure gauges play Simon Says. What one does, they all do. At first all gave an excessively high reading. Now, all give an excessively low reading. None of the readings are normal. For example, the fuel gauge shows three-quarters full when the fuel tank is filled. What's my problem?—John Sweeney, Middlesex, N.J.*

There's a small "black box" called the constant voltage regulator which controls all instruments. It has apparently gone blooey. On a Ford, this part is beneath the dash just to the left of the headlight high-beam indicator when you sit behind the wheel. In a Mercury, it's beneath the dash near the ignition switch.

You will notice that two leads are connected to the part. Disconnect the leads, remove the part and take it to the parts department of a Ford or Mercury dealer. The man will give you a new one, which you should re-attach beneath the dash. Hook up leads, which cannot be accidentally reversed, because one is male and the other is female.

## Tumbling a stumbling engine

*The 1970 Dodge Charger with 383-cu.-in. engine I purchased recently couldn't charge its way through the front four of a Pop Warner football team. It stumbles so badly that we've nicknamed the car Tanglefoot. Two extensive tune-ups have resulted in big bills with no results. A buddy says you have all the answers. Prove it.—Ralph Macmillan, Atlanta, Ga.*

Maybe not all the answers, Ralph, but if your engine is equipped with a Carter two-barrel carburetor, I probably have the answer you need. From 1968 to 1971, the top of this carburetor was made of zinc, which warps rather easily. A warped air horn or fuel bowl cover produces an air leak between the fuel bowl and venturi section that reduces pressure in the bowl, resulting in delivery to the engine of a fuel mixture which is too lean.

You can check for warpage by removing the air horn and laying a straightedge across the air horn's lower surface. Hold the straightedge

parallel to the choke shaft and in line with the air-cleaner stud. If you can insert a .011-inch or thicker feeler gauge between the straightedge and air horn, warpage is too much.

What should you do about it? Well, you can get a new carburetor, which is now made of aluminum. Or install a repair kit, which you can order using Carter service kit No. 180-220 or Chrysler No. 3579031.

## Hot lips

*I took my 1975 Chevrolet Monza to a specialty garage yesterday to have the front end aligned. The manager told me that he couldn't do the job, because my car has aluminum wheels, and I should take it to a Chevy dealer. Is this an indication of something strange about this car which I wasn't told when I bought it and which now is going to cost me more than the usual \$12 or \$15 for alignment service?—Fran Shaw, Modesto, Calif.*

No. All the incident indicates is that this particular garage doesn't have the equipment necessary for handling your aluminum wheel as-

semblies. The aluminum wheels on your Monza don't have the conventional lip configuration needed for attaching some makes of alignment and balancing fixtures. What the shop could have done is remove the aluminum wheels (and tires) and replace them with a set of regular Monza or Vega steel wheels (and tires) just for doing the alignment.

If wheel weights ever have to be added to balance those wheels, keep in mind Chevrolet has issued special weights which will clip on the inner and outer rim lips.

## The law, doodads and all that

*Would you please comment on ads I've seen concerning components that claim to increase fuel economy by fantastic amounts when added to an engine. Are they really as good as the ads say they are? Also, I thought that installing any part not originally put on the engine by the manufacturer was against the law, because it might affect emission control standards.—Elliott Norman, Jacksonville, Fla.*

All I can tell you about add-on gadgets is what reliable sources have told me. According to Virginia H. Knauer, the President's assistant for consumer affairs, the Department of Transportation has tested more than 150 retrofit devices for which increased gas mileage claims (some by as much as 40 percent) have been made.

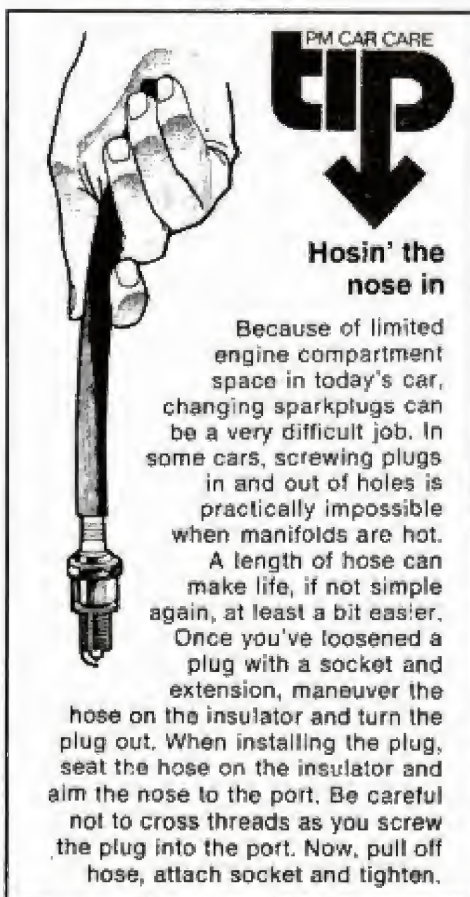
"The results to date have been negative," Ms. Knauer states.

In other words, they don't do what the manufacturers say they do.

In a report to Congress, the Transportation Department states that "in general, simple retrofit devices do not offer significant fuel economy improvement possibilities for most of the U.S. automobile fleet, particularly for late model cars."

Concerning the question of who is liable under federal law, it breaks down into two groups: (1) new-car dealers and (2) everyone else. Federal law prohibits new-car dealers from altering or tampering with emission control systems on any car, from installing "special" exhaust and induction systems, and from removing or disconnecting emission

(Please turn to page 52)





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## CAR CLINIC

(Continued from page 50)

control devices. A dealer can't even install a 1974 engine in a 1975 car, because the '75 car isn't certified for a '74 engine. Furthermore, he can't change engine settings from published specifications.

If caught doing any of these things (and some dealers have been caught), he can be fined up to \$10,000 for each violation.

There are no federal regulations governing the actions of private parties, independent garages and gasoline stations. Those in this group may do whatever they wish with an engine and its emission controls without violating federal law.

However, some states have strict laws that prohibit tampering with or removing emission control equipment.

### Drained of strength

*The battery in my 1974 Pontiac Catalina refuses to stay charged although a specific gravity test following recharge indicates the battery is full of pep. A day or so after its being recharged, I'm stuck again with a dead box. Should I replace this battery, which is only two years*

*old, with a new one?—Irwin Seidler, Philadelphia, Pa.*

I should say not. There is apparently a drain on the battery which is drawing off its charge. You can confirm this by performing a current draw test with a simple 12-volt test light. Make sure all accessories and the ignition are turned off, and that the car's doors are closed so the interior lights are out.

Disconnect the positive cable from the battery and connect one end of the test light to the cable terminal. Connect the other end of the test light to the positive battery post. If you have a probe-type test light, probe the positive battery post instead.

Have someone open one of the car's doors so you can confirm that the test light is working properly. The light should glow. Now, close the door. If the test light continues to glow, something is draining current from the battery.

Common causes of battery current drain are found in the trunk and in the glovebox with lights. A defective or incorrectly adjusted switch may be allowing one of those bulbs to glow with the lid closed. To check out this possibility, open the lids and simply touch each bulb. If either

bulb feels warm, you've found the drainer of battery current. Another common cause of battery drainage is a stoplight switch that's hanging up, permitting stoplights to glow at all times. You should check this, too.

### Yellow, but still Valiant

*The Plymouth dealer where I bought my 1976 Valiant says it is normal for the brake fluid to be yellow. I don't believe it, and I've insisted that he flush the brake system and install fresh fluid. He says he'll do it, but I'll have to pay for the service. I'm ready to explode, but I need your backing. Do I get it?—Morris Emes, Fort Worth, Tex.*

Sorry, can't do it, Morris, because your dealer is right. You took delivery of an early production model, which was one of those that during the first 60 days of '76 production had dyed brake master cylinder secondary springs installed. The springs were coated with yellow coloring so they could be easily identified and installed without mistake in '76 model master cylinders.

Brake fluid in the master cylinder dissolves this dye, which causes the fluid to assume a yellow, cloudy color. I assure you, because Chrysler

(Please turn to page 54)



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## CAR CLINIC

(Continued from page 52)

Corp. has assured me, that this dye and the color change will in no way affect the brake fluid or hamper braking. Go with confidence.

### Unleashing a Bobcat

*My 1976 Mercury Bobcat is a great set of wheels, except in wet weather. Then it acts like a pussycat, refusing to start. The dealer has tried, but failed. Can you help?—Arthur Pick, Knoxville, Tenn.*

This no-start, wet-weather condition is caused when high-voltage leaks to ground at the coil-to-distributor boots because of excessive moisture mixing with contamination such as salt and dirt.

The solution is to wipe off all moisture and dirt that has accumulated on exposed surfaces of the distributor cap and coil tower without disturbing or removing any wires except those that are obviously damaged. Now see what happens.

If the no-start condition prevails, remove the high-tension wire from between the coil and distributor, and wipe the coil tower and center tower of the distributor cap clean. Apply a thin coating of Dow 111 or Gen-

eral Electric G-661 silicone grease to the outer surfaces of the coil tower and distributor cap center tower. Reseat high-tension wire securely.

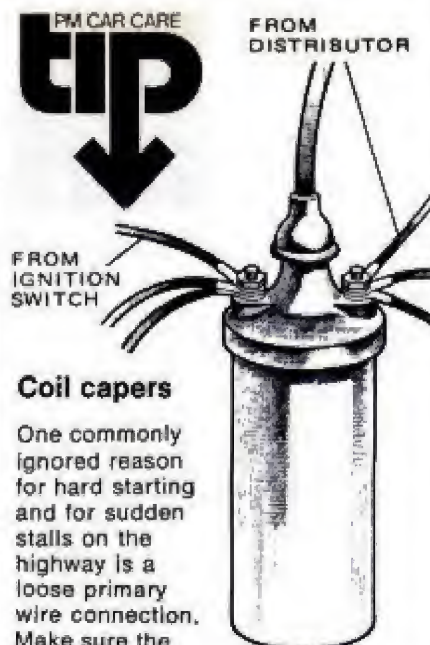
Now if the engine won't start easily, replace the high-tension wire with a new one.

### SERVICE TIPS

■ 1975 and 1976 American Motors cars that are hesitating, stalling or stumbling should have the in-tank fuel filter (part No. 3163974) replaced. For signs of a plugged filter, look for hesitation and stumble to be progressively worse and occur more often as the fuel level gets lower and lower (while you are driving at highway speed or accelerating); also suspect the filter if you can't restart a stalled engine in three to six minutes.

■ Chrysler Corp. advises that heavy sparkplug fouling, especially plugs Nos. 1 and 6, during cold weather with its 1975 and 1976 225-cu.-in. engine can be remedied by installing a new choke package (part No. C-4049219) and revising carburetor settings. Dealers are authorized to do work in service bulletin 08-05-76.

■ If your 1975-76 Granada, Maverick, Monarch or Comet spits at you when you fill the tank or has to be filled very slowly, you can have the fuel filler pipe replaced with a new one as spelled out in article No. 1355, service bulletin 104. ★★



### Coil capers

One commonly ignored reason for hard starting and for sudden stalls on the highway is a loose primary wire connection. Make sure the wire at the coil from the ignition switch is tight.

Make sure the wire on the distributor side of the coil is tight.

Trace the wire on the distributor side of the coil to the distributor itself and make sure the connection is tight at the distributor.

And a fourth tip. Check the insulation covering the coil-to-distributor wire. If worn or cracked, replace wire.

# New Aftate™ for Athlete's Foot is better, much better... it's The Killer.

**Aftate contains a special medication proven more effective in killing Athlete's Foot fungus than the medication in the best-selling brand.**

To the millions of Athlete's Foot sufferers looking for relief from burning, cracking and itching, we introduce Aftate. Aftate kills all major types of Athlete's Foot fungus and helps prevent reinfection.

### 4 effective treatment forms.

Spray liquid and gel (red label); use for the treatment of even most stubborn cases.

Spray and sprinkle powders (blue label); use for daily foot care and to help prevent reinfection.

**Aftate**  
Better,  
much better...  
it's The Killer.



(Aftate is odorless, too.)

© PLOUGH, INC. 1976



# 6 good reasons (and 1 super reason) why your new freezer should be a Kenmore.

**1** **Lots of space.**  
Sears Best Kenmore Freezer gives you 19.5 cubic feet of space, the extra room you've been wanting. Shop less often. Spend lots less time in supermarket lines.

**2** **Porcelain-on-steel interior.**  
Durable, easy-to-clean, highly resistant to rust and stains.

**3** **Even this door has more convenient storage.**  
Sears exclusive Space-master door design gives you 4 different kinds of extra storage space: 1) a sliding package dispenser; 2) removable Handi-Bin for odd-shaped packages, leftovers; 3) adjustable juice-can shelves; 4) adjustable package-shelves. There's *no* wasted space.

**4** **Power-Miser Switch helps save electricity.**  
Turn the switch to dry when room humidity is low. This door seals tight with a *magnetic* gasket. Cold air is sealed in; hot air is sealed out; operating costs are kept down.



The six good reasons apply to Model No. 2757. Also available through the catalog No. 2657.

**5** **Absolutely no defrosting — ever.**  
Sears Best Kenmore is completely frostless. No messy cleanups. No need to protect food while defrosting. There is no frost buildup on packages inside, so the packages don't stick together. Even the labels stay easy to read.

**6** **Glide-out bottom basket.**  
Holds bulky packages. Makes even the packages way in the back easy to get at without groping or fumbling.

**7** **The Super Reason: Kenmore means Sears service.**  
Just call the nearest store. We'll be there as fast as we can. We usually finish the job on our very first visit. Don't forget Sears value, dependability and convenient credit plans. Only at Sears, Roebuck and Co.



## Kenmore. Solid as Sears



**NEWS RELEASE 1976**

**OFFICIAL TESTING LAB RATES ALLISON #1... the BEST of ALL Ignition Systems!**

The ALLISON "Opto" was Officially Rated #1 by a Foreign Government Testing Laboratory as the BEST "Fuel Saving" Ignition of ALL the Ignition Systems Tested, including Systems with C.D. "add-ons"!

**NEW ALLISON 'OPTO XR-700'**

with the Exclusive... "Built-In" SOLID-STATE VOLTAGE REGULATOR

The "XR-700" is a NEW, redesigned, EASIER TO INSTALL version of the Allison "Opto-Electric", with the New addition of the Voltage Regulator, making it the MOST RELIABLE and Fool-Proof Ignition System ever invented.




**\* Allison replaced the mechanical Breaker-Points and Condenser with a "Highly Accurate" Optical Control.** A Beam of Light, passing through a specially designed "ROTOR" precisely triggers a Heavy-Duty "POWER MODULE" that BOTH "Charges and Fires" the Ignition Coil, with the "FASTEST" High Voltage RISE TIME, producing the MAXIMUM "HIGHEST ENERGY" SPARK available.

**\* Since there is NO Mechanical Friction, there are NO Parts to ever WEAR or need replacing, and ONCE properly Timed, it should NEVER need any Maintenance!** DWELL never needs adjustment, it is PRE-SET to supply the OPTIMUM Performance at BOTH High and Low Speeds. The RPM Capability of the "XR-700" is Factory Tested to 15,000 RPM.

**\* The "High-Energy" SPARK INTENSITY and DURATION...** permits the Positive FIRING of Spark-Plugs, even under the MOST ADVERSE conditions, results in more COMPLETE COMBUSTION and Eliminates "Engine Misfire", hence fewer exhaust Emissions, IMPROVED Fuel Mileage, a HIGHER Performance Level...and helps keep Plugs FROM FOULING, which greatly extends the Spark-Plug LIFE!

**\* Only the Highest Grade (U.S. Made) Solid-State Components are used... UNAFFECTED by Moisture or Vibration!** The Allison "XR-700" was engineered to OUTLAST the LIFE OF YOUR CAR!

**\* "EASY-TO-FOLLOW" INSTALLATION.** (Not Necessary to Dismantle your Distributor.)

**\* "XR-700"...Designed for those who want the BEST in Performance, Gas Mileage, Quicker Starting, Eliminate frequent Tune-Ups and Maintenance Costs.**

**FACTORY-BACKED 10-YEAR WARRANTY.**  
FREE Unit Repair or Replacement on Any Defect

**\* ORDER WITH CONFIDENCE...**  
Remember, even if you PAY Three Times as much, you cannot get a better Ignition System than the "XR-700"!

**\* SAVE! ORDER FACTORY DIRECT.**  
Send Check or M.O., Car Make, Year, No. Cyl. (4, 6, or 8-Cyl.)

**\* You may use your MASTER CHARGE or BANKAMERICARD.**  
Send us (1) Your Number, (2) Interbank No., (3) Exp. Date.

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If you have already installed a "Capacitive-Discharge" Ignition...  
**\* Convert Your "C-D" Unit to BREAKERLESS!**  
**INCREASE ITS EFFICIENCY with "XR-CD"...Only \$34.95**

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# HINTS

## FROM READERS

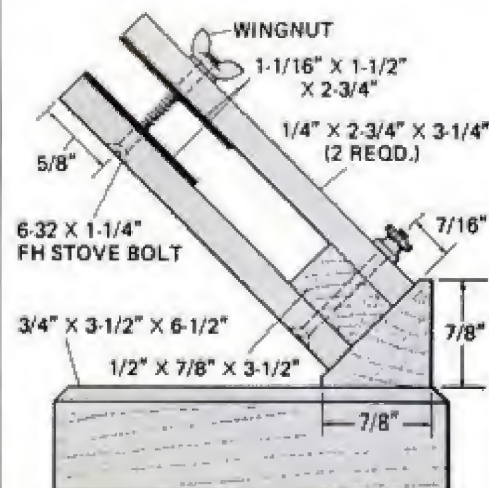
### Micrometer stand



A handy micrometer stand can be made from scrap wood, four 6-32 bolts with wing and knurled nuts, four washers, four wood screws and sheet felt from an old hat.

The micrometer frame is held between felt-padded surfaces of two 1/4-in.-plywood jaws. The bottom ends of the jaws are secured with two bolts to a wooden strip having a thickness about 1/8 in. greater than the micrometer frame. The felt glued to the jaws makes up the difference between jaw spacing and frame thickness. Two bolts near the upper ends of the jaws clamp the micrometer tightly. Wing and knurled nuts are used for ease in loosening all bolts when inserting or removing the mike.

The jaw assembly is tilted about 45° from the base for ease in reading the scale. —Walter Burton



## BUILD "A WORKING STEAM ENGINE!"



**Exact Replica Of Old-Time Single Acting Engine.  
Educational And Fun. Control Its Speed! Blow Its Whistle!**

Have the fun of building a steam engine that works... that's an exact replica of the old-timers. Then see how it can power erector set assemblies, and more! See how, in actual operation, it vividly demonstrates many of the fascinating, basic fundamentals of the steam engine, so important around 1900. This one's a Single Acting Engine (power stroke occurs only when the piston moves in one direction). Your dry-fuel steam power plant runs on tap water. You control its speed with the throttle valve. You make its whistle blow. Under adult supervision, this realistic

and powerful steam engine (with automatic safety valve) will provide countless hours of instructive enjoyment for mechanically or scientifically minded youngsters. Used in many physics classes, it's fun for adults, too. Explicit assembly and operating instructions are included, along with 20 dry-fuel tablets. Easily assemble the kit's 35 expertly crafted, precision parts in 2 to 3 hours. Then turn on the steam and watch the fun. Base is 7 1/2" sq.; height, incl. stack, is 8 1/4"; length is 6".

**\$27.50**

STOCK NO. 72,202H..... JUST ppd.  
NO. P-42,324H EXTRA DRY-FUEL TABLETS (PKG. OF 20)... \$1.95 ppd.

**COMPLETE AND MAIL COUPON NOW**

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\_\_\_ Steam Power Plant Kit(s)

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# Convert your leaf blower to a snowblower



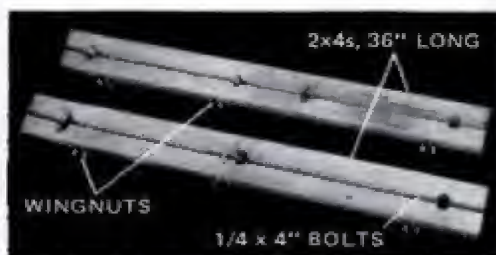
**W**hy have a leaf blower sit around all winter when it could be blowing snow off your driveway? I found that by teaming my 5-hp Jet-Sweep with an 18-in. pusher-type snow shovel I could plow my 80-ft. double-width driveway in less than 20 minutes (light or heavy snow). The strong air jet blows the snow aside as fast as the shovel scoops it up, and as clean as a broom.

All the changeover requires is two clamp-on wood crossarms to hold the

shovel so the blade's edge is just to the rear of the blower's air jet. The crossarms are 2x4s bored to suit the shovel handle and the blower handles, then drilled edgewise for 1/4-in. carriage bolts and wingnuts. Finally, they're ripped down the center.

If the shovel edge catches on the driveway, bend the blade up a bit so it rides flat. You'll find the shovel vibrates rapidly as it's pushed along, which helps it loosen the snow.

—Lorma Hyppia



Working outward from the garage, I found it best to push and pull the blower at an angle rather than straight ahead so the blower's wheels are always on a cleared area and won't skid and slide.



## What a difference a Yashica makes.



The picture on the left was taken with a popular 110 pocket camera that sells for about \$115. The picture on the right was taken with the Yashica Electro-35 GSN which sells in the same price range. The difference is obvious.

The Yashica is small, compact and surprisingly simple to operate. More importantly, Yashica gives you full-frame 35mm

quality plus the Yashica electronics and optics that no 110 camera offers. Shooting with a Yashica makes picture-taking more fun, because you know the results will be superior.

Pick a Yashica and discover the difference the pros have known about for years.

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**Yashica cameras.**  
From under \$100  
to over \$1,000



# Pinto kicks up

## New style...sporty handling



1977 Ford Pinto 3-door Runabout. Exciting new front and rear styling.

### Spirit you can see.

A highly spirited new Pinto has been born for 1977. Highly spirited with a fresh new look that will still be exciting and distinctive years from now.

Pinto for '77 is highly spirited with new options, too. Like our new glass third door, a flip-up/removable open air roof, and Pinto's new 4-way driver's seat (it easily adjusts up and

down, as well as fore and aft) for more convenience, more comfort.

So you can make your exciting new Pinto even more exciting.

### Spirit you can feel.

For '77 our spirited new Pinto is as nimble and sure-footed as ever. With rack-and-pinion steering, a strong 2.3 liter 4-cylinder engine

and a quick and responsive four-on-the-floor manual transmission. Automatic is optional.

But for even more spirit, there's Pinto's optional 2.8 liter V-6 engine with automatic transmission. Or equip your Pinto with the optional sports rallye package and get a new fun-to-drive suspension, for the sportiest handling Pinto has ever had.



One of our beautiful new interiors. Proof that the practical Pinto can also be luxurious.



Sports rallye option: sport steering wheel, rallye instruments and special suspension.



Our electro-dip priming process: part of our Improved Corrosion Protection Plan for '77.



# its heels for '77. ...winning performance.



**FORD PINTO**

FORD DIVISION



## Spirit that lasts.

But the beauty of the '77 Pinto doesn't stop with its great new look and excellent performance. To make sure your high spirited Pinto lasts, here's Pinto's built-in durability. Durability that starts with the electro-clip prime coating of Pinto's entire unit-body construction.



Ford Pinto wagons; more beautiful, but just as practical as ever.

And for '77, critical areas around all front lights are now made of a new resilient material that's dent, chip and crack resistant under normal use...and absolutely rustproof.

## How a 1976 Pinto Pony beat the two leading imports on hills, highways and in passing tests.

In performance tests certified by The United States Auto Club (USAC), Ford engineers and drivers compared a 1976 Ford Pinto Pony against a 1976 Datsun B-210 and Toyota Corolla. All cars were tested with base engines, manual transmissions and 49-state emissions.



In the hillclimb test, Ford's Pinto Pony climbed better than both of them.

In the acceleration test, Pinto Pony reached 55 mph faster than both of them.

In the passing test, Pinto Pony moved out and passed a moving trailer truck quicker than both of them.

For a summary of the tests, write USAC Properties, Inc., P.O. Box 24001, Speedway, Indiana 46224.

Or see your local Ford Dealer.

Find out how easy it is to corral the spirited '77 Pinto.

Test drive and test price a Pinto at any one of the 5,600 Ford Dealers from coast to coast.



Our most economically priced Ford Pinto, the Pinto Pony. Shown here with optional white sidewall tires and deluxe wheel covers.



When America needs a better idea, Ford puts it on wheels.

Always wear your seat belt. Always use proper tie-up technique.



# HOMEOWNERS' CLINIC



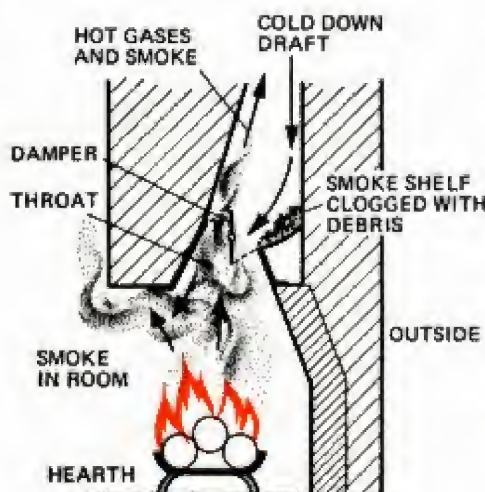
## Save that leather desktop

*I'm stripping and refinishing an old desk that has a leather top inlay, and wonder how to clean and finish the leather. It seems in good condition other than containing slight checks and general aging. I'd appreciate any advice.—Manuel Kaufman, Fresno, Calif.*

If I understand you correctly, the leather top needs only a cleaning with saddle soap, a preservative conditioning and refinishing. After saddle soaping the top, apply a preservative and enricher that will reintroduce some oil into the leather. "Lexol" is one such preservative. Then apply a lacquer for a shiny finish, or a wax for a matte finish. "Lac-Kote" and "Neat-Lac" are both commercial lacquer finishes that leave a shiny protective coating. They should be applied about once a year. A paste wax or butcher wax will leave a duller finish than the lacquers. They are somewhat more difficult to apply, as they can leave streaks, and should be reapplied every six months. However, many people prefer this more subdued finish that gives the leather a softer, mellower look, rather than a slick, shiny look.

## Smoke gets in your eyes

*Last fall I cleaned my fireplace flue with a sack filled with dry grass clippings and a weight. I lowered and raised the sack up and down the length of the flue. Since the "cleaning," my fireplace smokes. It had given me no such trouble before. What could be wrong?—R. Weston, Boston, Mass.*



You didn't finish the cleaning. Much of the debris you loosened when cleaning the flue lodged on the smoke shelf, which deflects the downdraft and is standard in most masonry chimneys. When the shelf is clogged with debris as in the exaggerated detail, an eddy occurs with the result that smoke enters the room. Removing the damper is, in most cases, impossible. You'll have to snake your vacuum cleaner hose past the open damper to remove that debris. Experiment with your damper setting; close it as far as possible without the fireplace smoking. You'll get more heat in the room.

## Waterproof basement walls

*What can be applied to the room or cellar side of a cement-block wall to stop water from working through?—Geo. C. Colburn, Peterborough, N.H.*

Much depends on the condition of your basement wall, whether the blocks are free of cracks, the joints sound, the wall leaning and other possible defects. If there are wide cracks, fill them with a hydraulic cement such as Drylock Fast Plug by United Gilsonite Laboratories. Remove any mineral deposit (white powderish substance) with a 10-percent muriatic acid solution or UGL's Drylok Etch. Otherwise, just clean the wall and apply a masonry waterproofing. Most such products should be applied with a brush instead of a roller for good filling.

## Loose rungs make wobbly chairs

*The rungs on my wooden kitchen chairs are loose, but only pull out part way from the hole in the leg. Is there some way to tighten them without taking the chair apart . . . perhaps a glue that can be forced into the joints around the end of the rungs?—Lee Bower, Sacramento, Calif.*

It may be possible to tighten the rungs by pulling them out as far as possible and applying a product called "Chair-Loc" or white glue around the rungs. Push the rung in and out of the hole to force the glue into the joint. Then push the rung as far as it will go and hold it in place with a tourniquet or clamp. Allow the glue to set. You might also force glue into the hole with a needle-

nosed glue injector that can be purchased from Craftsman Wood Service Co., 2727 S. Mary St., Chicago, Ill. 60608.

## Wallpapering plasterboard

*I want to wallpaper over unfinished plasterboard walls, but I'm told that I will not be able to remove the paper later the usual way by wetting and scraping. How can I prepare the wall to permit easy removal of the paper?—Ed Gibson, Montreal.*

Assuming the joints of the plasterboard walls have been nailed, taped and spackled in conformity with generally approved practices, the walls might be coated with a latex or semi-gloss paint. I would give the taped joints a prime coat of paint (or shellac) and allow this to dry thoroughly before applying the final coat. As a rule, one coat of either type of paint will be sufficient, if applied unthinned with a roller. Be sure the paint is completely dry before you hang the paper.

## Condensate on aluminum frames

*During cold weather moisture gathers in drops on the frames of my aluminum window sashes. In time—if I don't wipe the frames regularly—a black mold forms. What can I do to prevent this? I don't mind the moisture, but I can do without the mold.—Jim Neitzel, Shelley, Idaho*

Yours is a common problem and there seems to be no completely effective remedy that I know of. I do know that coating the metal frames with ordinary glycerin tends to reduce the formation of condensate, often to the point where it is no longer especially troublesome. Of course, one hesitates to suggest this step due to the greasy accumulation as a result of this remedy. Though as a last resort it is helpful. Storm sashes also will help, but to be effective they must be fitted tightly. ★★

*Do you have a home maintenance or repair problem? Send it to Homeowners Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.49 postpaid. Send orders to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.*



# TASTE THE GOOD TIMES. RALEIGH



Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.



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1,000 Raleigh gifts, write for your free Gift  
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Filter Kings, 16 mg. "tar," 1.1 mg. nicotine; Longs, 17 mg. "tar," 1.2 mg. nicotine, av. per cigarette, FTC Report Apr. '76

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# Introducing '77 Ford pickups.

## Tough trucks made tougher.



Year by year, Ford pickups have built a great record for durability. Now they're built even tougher: New high-efficiency V-8's designed for extra reliability. New anti-corrosion measures that include fender liners front and rear. New low scheduled maintenance needs, and more. See the '77s—regular cab and SuperCab, America's roomiest 2-door pickup—at Ford Dealers now.



### Tough Twin-I-Beam

The only front suspension with the built-in strength of two forged axles.

### Typical '77 pickup

- galvanized
- rustproof fender liners
- pre-coated steel
- zinc-rich primer



### New rust protection

Over 350 sq. ft. of anti-corrosion coatings like galvanizing. New rustproof fender liners, too.



### Deep comfort

Ford's seat is full foam, 7 inches deep. Behind seat is storage space.





### New efficient V-8's

Choice of new 351 and 400 V-8 options. Ford's modern design offers optimum engine power and performance.



93 out of 100 of all Ford trucks registered over the last 12 years are still on the job.

# FORD

FORD DIVISION





# EMPEROR HAS IT ALL!

## HIGH QUALITY... LOW PRICE!

OUR MOST POPULAR MODEL 120-K

DO-IT-YOURSELF CASE KIT

## SOLID 3/4" BLACK WALNUT

Build this beautiful grandfather clock, complete with Westminster chiming movement-Tempus Fugit Dial, for just \$209.00. Add \$15.00 for Moving Moon Dial (as shown). Compare your finished clock with those retailing up to \$850.00.

# 94<sup>50</sup>

FACTORY  
DIRECT

When purchased with movement (extra),  
Or, case kit alone \$104.50 Reg. \$149.50

### EMPEROR ALONE MAKES THIS POSSIBLE

Emperor Clock Company, for years the world's largest manufacturer of grandfather clock kits, is the leader in quality, the leader in price. Nowhere can you match the value you get from Emperor. Why? Because our high volume allows us to purchase solid hardwoods in huge quantities and receive the best prices possible. Then, we cut our own kits in our own woodworking plant, with efficiency and strict attention to quality. Many newcomers today are selling grandfather clock kits. But Emperor, the long-established leader, is the only firm in the nation operating its own woodworking plant to give you the highest quality at the lowest price.

Order your Model 120-K in gleaming solid 3/4" black walnut and enjoy the proud feeling of accomplishment by doing it yourself. When assembled, your clock will add beauty and grace to your home. All kit pieces are professionally pre-cut and sanded smooth on both sides. All miters pre-cut at no extra charge. (For those who prefer, kits may be ordered unmitered.) Divided swan neck and finial, waist and dial face doors, dial frame and sculptured basefront are pre-assembled. Complete assembly instructions included. No woodworking experience necessary. Each piece may be reordered separately.

Model 120  
Solid 3/4" Black Walnut  
74" x 16 3/4" x 10"

- Solid, heavy-gauge brass West German movement and dial face
- Four full-turned classic hood columns
- Divided swan neck and decorative finial
- Full-length waist door
- Built-in floor levelers
- Deluxe brass-finished hardware

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If for any reason you are not completely satisfied, return in original shipping carton within thirty days for prompt refund... no questions, no excuses.



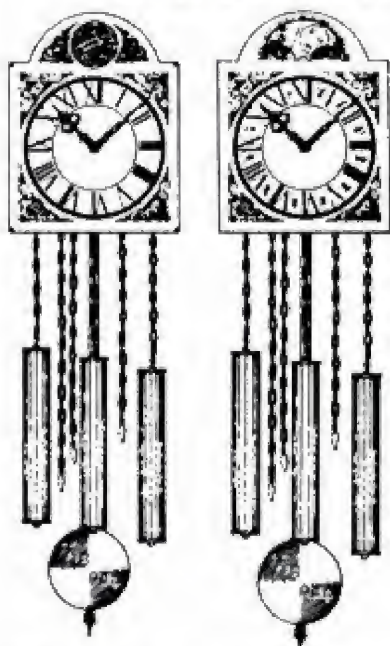
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OF GRANDFATHER CLOCKS

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## EMPEROR MOVEMENTS AND DIALS FOR MODEL 120-K



**100-M Movement  
with Tempus Fugit  
Dial \$114.50**

**100-M Movement  
with Moving Moon  
Dial \$129.50**

**MOVEMENT CARRIES A  
ONE YEAR WARRANTY**

**Made In West Germany of Solid Brass**

**EIGHT DAY • WEIGHT DRIVEN • WESTMINSTER CHIMES**

Emperor movements are made in West Germany by a family of clocksmiths now in their third generation of building the world's finest clockworks. These movements are made of highest quality solid brass, with pinions of hardened steel. Emperor dials also are manufactured in West Germany by a renowned dial making firm, famous for its solid brass craftsmanship. Both movements and dials are made to Emperor's rigid specifications to last for generations. Emperor movements include weights, solid brass weight shells, brass bob, pendulum and chimes.

Emperor's Model 100-M movement has two sets of musically-tuned rods. One set sounds the historic Westminster chimes: four notes on the quarter-hour, eight on the half-hour, twelve on the three-quarter-hour and sixteen on the hour. The other set sounds a Big Ben tone on the hour.

There are two dial versions of the 100-M movement. Both are solid brass and brush finished with black serpentine hands. Antiqued filigree spandrels frame the dial ring which has black Roman numerals. The Tempus Fugit (Time Flies) dial features a world globe framed by filigree spandrels. The Moving Moon Dial has a 29½-day lunar calendar. As it rotates, clockwise, the calendar shows in turn the phases of the moon, a woodland scene and a ship at sea.

Because each movement bears the Emperor name, it is thoroughly tested in our quality control room before it is shipped to you. We proudly stand behind our name 100%. Emperor West German movements and dials are known and valued everywhere for their lasting accuracy and dependability. Don't risk buying anything less.

Installation and adjustment is a simple operation following the step-by-step instructions supplied.

USE THIS FORM TO ORDER FACTORY DIRECT • OFFER EXPIRES DECEMBER 31, 1976

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EMPEROR CLOCK COMPANY, Dept. 39-M

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	Model 120-K Solid 3/4" Black Walnut Do-It-Yourself Case Kit with purchase of either movement (priced separately) below	49	\$149.50	\$ 94.50	
	Model 120-K Solid 3/4" Black Walnut Do-It-Yourself Case Kit without purchase of movement (priced separately) below	49	\$149.50	\$104.50	
	Model 120-A Solid 3/4" Black Walnut completely finished clock with Tempus Fugit Dial, Westminster Chimes	95	\$399.50		
	Model 120-A Solid 3/4" Black Walnut completely finished clock with Moving Moon Dial, Westminster Chimes	95	\$414.50		
	Model 100-M Movement complete with Tempus Fugit Dial, Westminster Chimes for Model 120-K	33	\$114.50		
	Model 100-M Movement complete with Moving Moon Dial, Westminster Chimes for Model 120-K	33	\$129.50		

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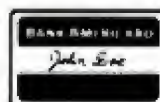
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# SCIENCE WORLDWIDE



## The latest thing in helmets

No, the soldier in the top photo is not a member of the German Army. He's an American GI who's wearing an experimental helmet that might replace the familiar M-1 steel "pot" used by the Army since World War II. New materials and design techniques were used to produce the experimental helmet, which is said to offer better head coverage, increased ballistic protection, and greater comfort and stability.

Now being field-tested, the new helmet is made of layers of Kevlar and fiberglass, and is shaped in a mold. It comes in one piece—in contrast with the M-1 combination of steel outer shell and helmet liner—and is available in three standard sizes. The sizes were determined by taking a raft of head measurements with a "numerical surface descriptor" (lower photo). The new helmet is said to fit 98 percent of all Army personnel while the M-1 fits only 90 percent.

## From CO<sub>2</sub> to fertilizer

A potential energy source that has been blown out of factory smokestacks for centuries is getting a new look from researchers at the Battelle Pacific Northwest Laboratories. The carbon monoxide discharged by steel-makers and other large industries, say Battelle chemists, could replace

natural gas in the production of hydrogen, methane, methanol, ammonia or urea—all with important industrial uses and some essential to modern agriculture. If all the steel industry's carbon monoxide were used in fertilizer production, for example, it would supply three times the annual national fertilizer requirements.

First steps in the study will include identifying industries and specific plants that produce large amounts of CO<sub>2</sub>, determining how the gas is recycled now and identifying improved uses for it. Later, researchers will look for ways to collect, concentrate and purify the now wasted gas.

## New way to spot tsunamis

A new warning system for tsunamis—the often destructive ocean waves generated by some earthquakes—will be tested at the University of Hawaii, Honolulu. University researchers have developed a radio method of determining the probability of a tsunami several hours in advance of its arrival in the Hawaiian Islands.

The new method takes advantage of the fact that the type of earthquake that generates a tsunami—a vertical-motion quake—also produces acoustic waves that cause disturbances in the ionosphere. These disturbances are detected by a radio probe.

Earthquakes characterized by horizontal movement have not been found to cause tsunamis, but standard ground-based detection devices do not provide a quick distinction between the two types.

The different kinds of waves created by the vertical-motion earthquake travel at different speeds. The ground waves reach the measuring instruments first, making it possible to determine magnitude and location. The tsunami waves travel in deep ocean as fast as 600 mph, but the ionospheric waves speed ahead at about 7800 mph, providing hours of warning time.

In the upcoming tests, funded by the National Science Foundation, the University of Hawaii system will be linked to the existing Pacific Tsunami Warning System, which is

limited by existing technology to slower and less sure methods of detection and forecasting.

## Good list for food shoppers

It's a wise food shopper who knows what she or he pays for at the check-out counter, especially for processed products. As an aid to consumers, the Department of Agriculture has published a list of over 200 popular meat and poultry products, describing required standards and specifying the amount of meat or poultry each product must contain. Meat pies, for example, must have at least 25 percent meat; condensed chicken soup, 4 percent chicken meat. For your copy of the Consumer Reference List, write: Information Div., APHIS, U.S. Department of Agriculture, 26 Federal Plaza (Room 1653), New York, N.Y. 10007.

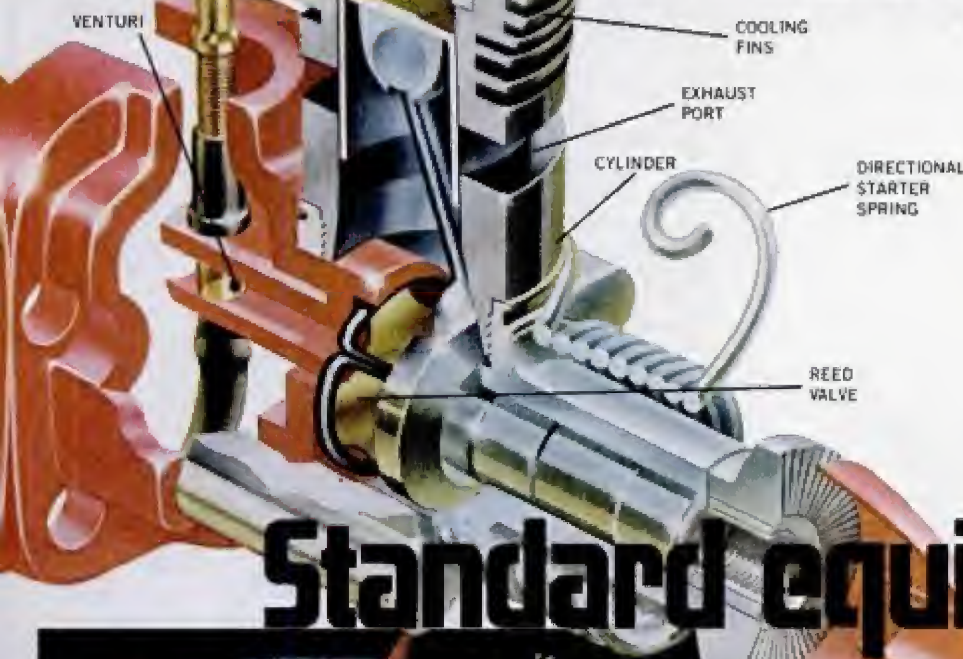
## Now: 'munchmeter' for cows



Special techniques and hardware were needed when West German agricultural researchers set out to investigate the eating habits of cows. They came up with the "munchmeter" worn by cow in photo. The device records jaw movements and the time of day the cow eats. The researchers also treated different fields with tracer chemicals so they could determine the kinds of grass favored by the bovines. All the data collected will be used to figure out how to get more and better milk from less grass. ★★



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# Tallest hotel is far out, too

Shaped like a cylinder, this 70-story giant has a lake for a lobby and a rotating roof.

by Stanley Abercrombie

**I**n the heart of downtown Atlanta, Ga., there is now a half-acre lake, but not in a park. It's in the lobby of a hotel—in fact, it *is* the lobby. The 115,000-gallon pool is just one of many spectacular attractions of Atlanta's newly opened Peachtree Center Plaza—a shimmering, 70-story-high, cylindrically shaped glass-and-concrete tower that enjoys two distinctions: It's the tallest hotel in the world and the tallest structure of any kind in the South.

Crisscrossing the "lake" are elevated walkways for patrons with posh cocktail lounges in circular pods cantilevered out over the water. But this is just the beginning. Located throughout the 1100-bedroom giant are shopping and service facilities to meet every need, 12 different dining and cocktail areas, special meeting rooms for business conventions and ballrooms for elegant entertaining. The lobby is actually a seven-story-high, skylighted atrium adorned by lush growths of plants, more than 100 trees, lavish tapestries, soaring columns and massive sculptures.

## Revolving rooftop restaurant

To top it off—literally—is a three-tiered rooftop restaurant, more than 700 feet above street level, that revolves—yes, *revolves*—to give diners a magnificent, moving panoramic view of Atlanta's skyline. It makes one revolution every hour—slow enough so as not to upset any delicate stomachs. Patrons are carried to and from the lofty dining room in glass-walled elevators running up the outside of the building—for an added

*(Please turn to page 71)*



**Cavernous lobby**, seven stories high (near left), features 115,000-gallon pool at bottom with cocktail lounges in overhanging pods. Massive central concrete core and surrounding columns support much of the building's weight. Small projection on outside of cylinder (far left) is glass-walled outside elevator that whisks diners up to rooftop restaurant. The structure, shown nearing completion above, is 70 stories high. How did they get the crane off the top? They had to have it hauled away by helicopter.



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The new Super XXV CounterVibe Automatic: when you can own a saw like this, why settle for an ordinary chain saw.

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The modern engine is a very forgiving machine. It'll faithfully start and run with spark plugs that are long

past their prime. But while it manages to run with old plugs, it can also be wasting that expensive gasoline of yours at a horrendous rate.

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We've been conducting a nationwide series of mileage tests on everyday cars like yours. And results show that most of the cars tested got better gas mileage after we simply replaced their worn spark plugs with fresh Champion spark plugs.

## So what'll it be. Plugs? Or gasoline?

If it were up to us, we'd sell you some fresh

Champion spark plugs. But it's your car and your money. We just figure a small jolt for fresh spark plugs beats slow death at the gas pump any day.

Whichever way you decide, we hope we've helped you save some money. You've worked too hard to let it go to waste.



**Fill 'er up  
with Champions.**





**TALLEST HOTEL** (Continued from page 68)

sightseeing thrill. Another food and beverage area features a 100-foot-wide waterfall, majestic sculptures and huge tubs of fresh flowers for a sumptuous atmosphere. The mighty Peachtree extravaganza is the brainchild of architect-developer John Portman, who is both designer and owner. It is being managed under a lease by Western International Hotels.

**Tricky construction job**

Erecting a 723-foot cylinder isn't easy anywhere, but this one had to be built on a tight site right at the corner of one of Atlanta's busiest intersections—without any disruption of traffic around it. So carefully were logistics worked out that during all the months of construction only one lane of one adjoining street remained closed for the delivery of equipment and materials. The uniquely designed cylindrical tower is supported by a central circular concrete core, carrying a structural load of 64 million pounds, and a series of 10 surrounding columns each taking an additional 10 million pounds. Finlike walls radiating from the core form pie-shaped wedges of space that house the hotel's bedrooms.

Pouring concrete 700 feet in the air proved to be one of the trickiest jobs. The concrete had to be hoisted up in stages, several floors at a time. Despite the complexity of the task, work progressed at the phenomenal rate of nearly one floor every three days. At the end, workers faced a dilemma—two large cranes on the roof. Getting one down was simple—the other lowered it to the street. But what about the remaining crane? Dismantled into sections, it was finally flown away by helicopter.

There is only one real problem with the Peachtree—swimming in the lobby isn't allowed. ★ ★ ★



**Unusual rooftop restaurant**, more than 700 feet high, slowly revolves to give diners a spectacular, ever-changing view of Atlanta's skyline. Its floor is so perfectly supported on friction-free bearings that only two ¼-hp motors are needed to turn it. Restaurant is one of 12 in luxury-loaded hotel.



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# A Yank tank mit German klout?

by Edward Hymoff

With the XM-1 finally under test, the U.S. Army's long campaign for a new battle tank seemed over. Then NATO partner West Germany asked for a bigger gun and other key modifications.



In South Korea, author interviews members of 1/72nd Tank Battalion who tested XM-1. Long experience with M-60 (in background) made them tough judges.



The two XM-1 prototypes—General Motors (top) and Chrysler—have low silhouettes, good stability, speed near 50 mph.

The gray mass of steel displaying the black-and-white cross of the German Army roars across the field and brakes to a stop. Gears grind and the tank quickly backs into a small gully partially screened by multicolored fall foliage. Inside the buttoned-up tank, four *Panzerschützen* confer over the intercom.

The tank commander gives the order to move out again and warns the driver to be *vorsichtig!* "Be careful!" The *Panzerkampfwagen* and its crew are in strange terrain and somewhere out there is "the enemy," following their every move. Sleek and low, the 60-ton monster dashes out of the gully at 34 mph, easily climbs a 20° slope and turns sharply onto a road pitted with ruts and potholes. Still moving fast, the armored vehicle turns off the road and roars across an uneven terrain studded with tank traps. Soon it is lost in the late afternoon shadows.

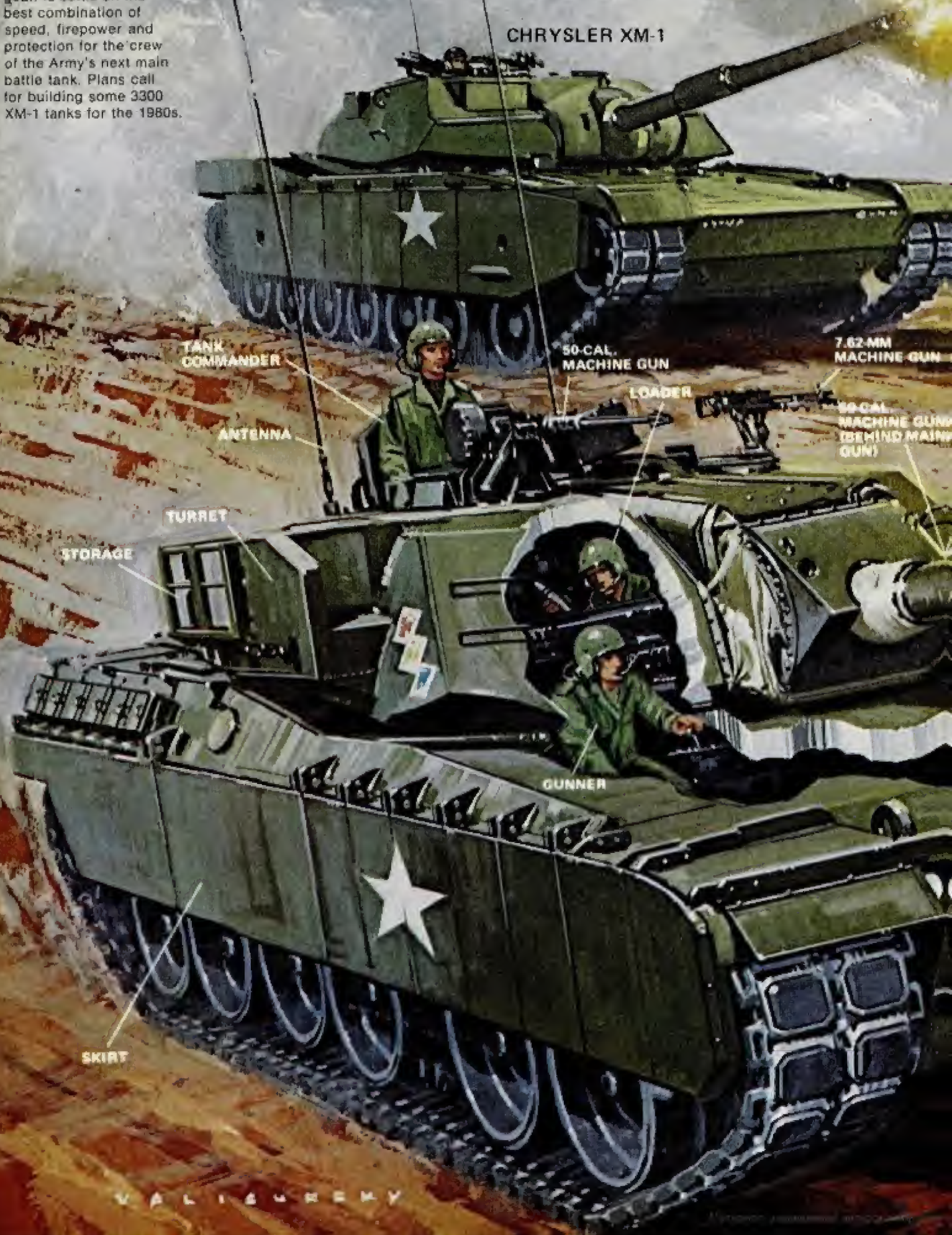
No, this isn't a scene from World War II. The time is now and the place is the U.S. Army tank proving grounds at Aberdeen, Md. Nor is this a captured World War II German Tiger tank being put through its paces. This agile bruiser is the West German Army's 1976 model Leopard II-A.V. Since its arrival in the United States early this fall, it has been undergoing comparative evaluation tests in a program that is proving as much a test of West German-American relations as it is of military hardware. Military men and politicians on both sides have interests to protect—and industrial giants in both countries have a lot riding on the outcome of the competition.

On the German side is Krauss-Maffei A.G. of Munich, builder of the Leopard tank, and on the American side are the makers of the two XM-1 main battle tank prototypes—General Motors and Chrysler. At



The Army's tough testing program involves the three prototypes shown: the General Motors XM-1, the Chrysler XM-1 and the West German Leopard II. The goal: to settle on the best combination of speed, firepower and protection for the crew of the Army's next main battle tank. Plans call for building some 3300 XM-1 tanks for the 1980s.

## CHRYSLER XM-1







LEOPARD II

105-MM OR 120-MM GUN

DRIVER

DRIVER'S PERISCOPE

ARMOR PLATE

HEADLIGHT

INFRARED HEADLIGHT

TREADS

GENERAL MOTORS XM-1

stake in the United States is a \$4.9-billion contract for 3325 of the new tanks, which Army officials claim are desperately needed to replace the 17-year-old M-60 series and the 24-year-old M-48.

The XM-1 main battle tank, to be named the "Abrams" after the late Gen. Creighton Abrams, Army Chief of Staff at his death and a highly decorated World War II battalion tank commander, also is in contention for what some armaments salesmen are calling "the contract of the century." What excites them is the possible standardization of all NATO forces and the adoption of the same weapons, ammunition and equipment, including some 10,000 main battle tanks. An estimated \$12 billion will be spent on tanks by the NATO powers during a 15-year period starting in 1979.

At the same time, the battle tank has become a highly controversial weapon. Some critics in Congress claim that the tank is as obsolete as the battleship. They cite the disastrous experience suffered by Israel during the first days of the October 1973 war in the Middle East when a

new generation of Soviet-built anti-tank weapons—Snapper, Swatter and Sagger—were employed with devastating results. Israel tank units suffered heavy losses, especially from single rocket rounds fired from the shoulder or from the Soviet-built BMP infantry combat vehicle.

Not only were the Israelis taken aback by their losses, but so were American military officials monitoring the new Soviet antitank weapons. Even Soviet military men were taken by surprise—so much so that for the past two years Soviet military planners have been engaged in a debate about the effectiveness of the battle tank in future combat operations.

#### Add-ons for the M-60

Before the XM-1 prototype was built, the U.S. Army developed a package of sophisticated add-on equipment for the M-60, including a laser rangefinder. But to our military men this was only a stopgap. The United States and her NATO allies needed a more modern tank to counter Soviet armored might.

This was the view even in the mid-60s, when the U.S. and German armies worked together to develop the MBT-70—a billion-dollar flop. Military officials of both nations couldn't agree on what should go into this new tank and so each country went its own way. The United States

(Please turn to page 140)



# World's longest 'people' tunnel

It will have taken more than 35 years to build, but when Japan's 33-mile-long undersea railway is finished it will represent one of the most ambitious and adventurous engineering feats ever.

by L. Donald Meyers

**A**ccording to the *Guinness Book of World Records*, the world's longest tunnel is the 85-mile Delaware Aqueduct running from tributaries of the Delaware River to New York City. But it carries water, not people. Japan is building a high-speed railroad tunnel that will far outdistance any "people" tunnel in existence. It will stretch 33.6 miles underground—14.5 of these under water—will encounter some of the most treacherous terrain any tun-

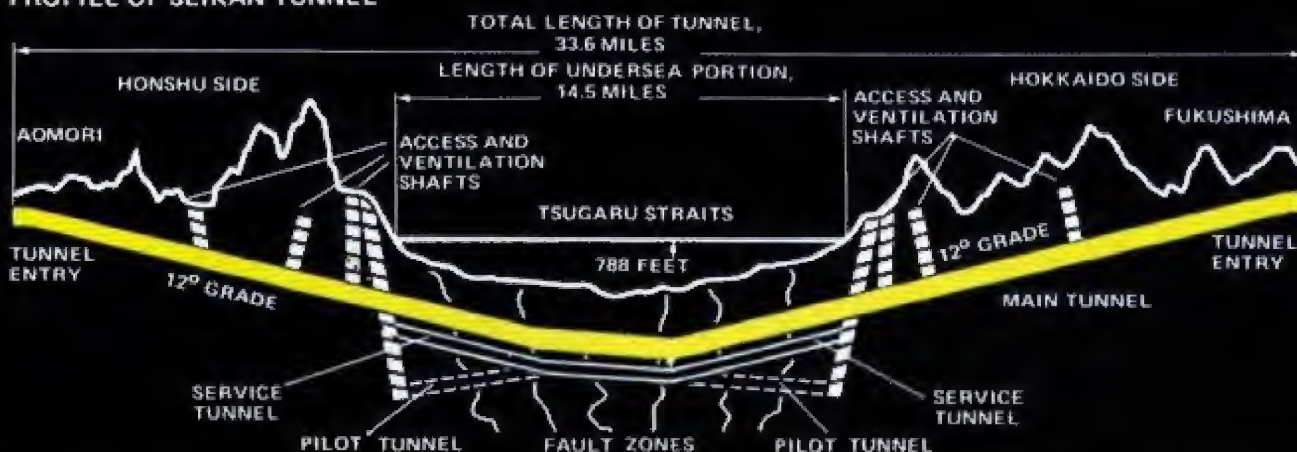
nel has had to face, and will represent one of the mightiest, costliest, most complicated engineering feats ever undertaken.

Called the Seikan Tunnel, it will fulfill a long-held dream of the Japanese people to be able to travel anywhere in their chain of four major islands by train. The largest, most populous of these islands is Honshu—the long, curving strip that forms the "body" of Japan's familiar dragon shape where

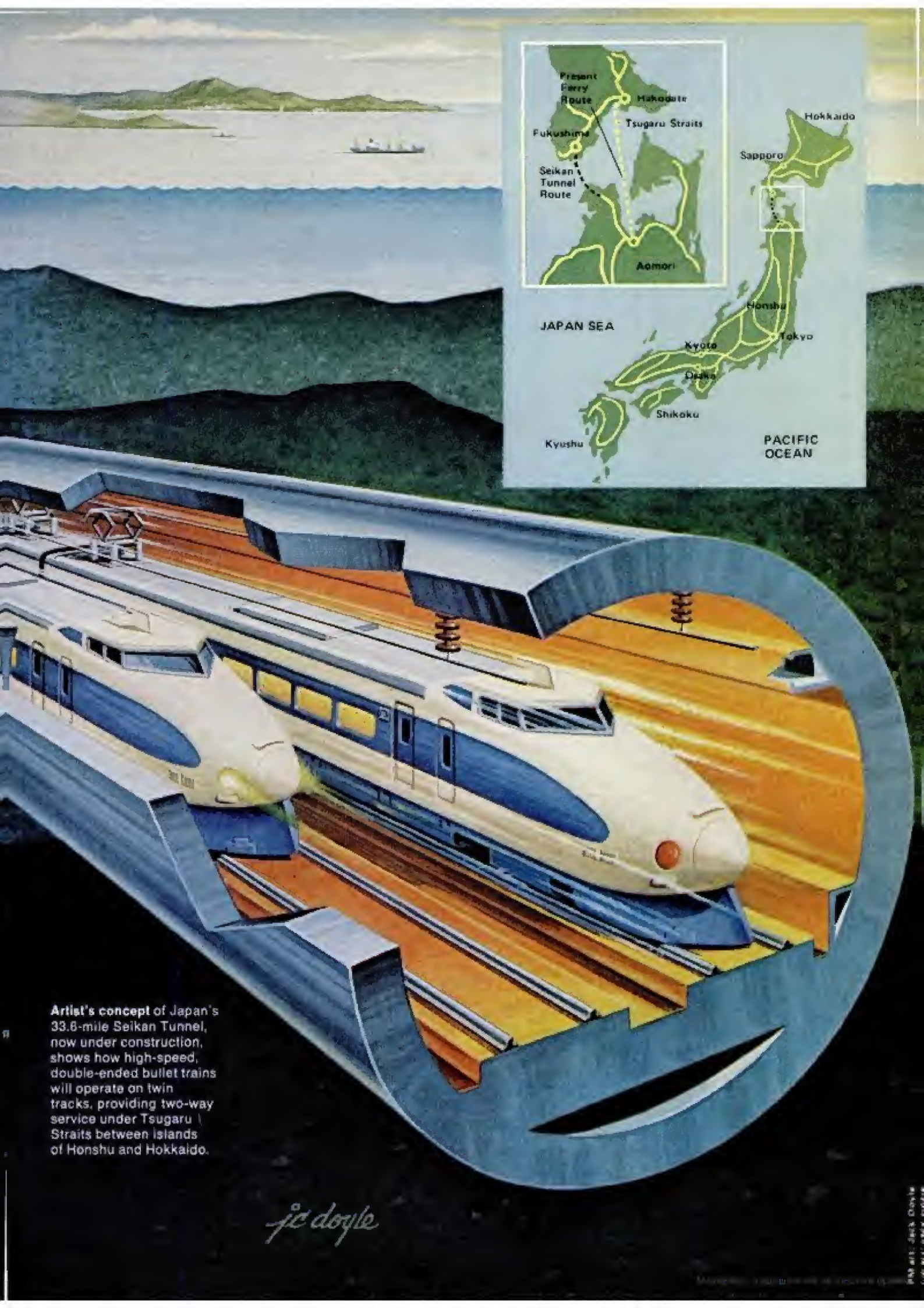
the biggest and best-known cities of Tokyo, Osaka and Kyoto are located. The dragon's "feet"—Kyushu and Shikoku—are already, or soon will be, linked by rail to Honshu. Only the dragon's "head"—Hokkaido—remains isolated. There are limited air and ferry services between the two, but the severe and frequent storms that rage in the Tsugaru Straits make such over-water crossings uncertain and often

(Please turn to page 162)

PROFILE OF SEIKAN TUNNEL







JAPAN SEA

PACIFIC OCEAN

Artist's concept of Japan's 33.8-mile Seikan Tunnel, now under construction, shows how high-speed, double-ended bullet trains will operate on twin tracks, providing two-way service under Tsugaru Straits between islands of Honshu and Hokkaido.

*jc doyle*

PHOTO: Jack Doyle



# New gear that conquers the cold

Now space-age clothes and gadgets let you plug in, switch on or bounce back body heat.

by Bill McKeown OUTDOORS EDITOR

**T**he hottest news in cool-weather wear is an assortment of aids that could keep you comfortable under a snowdrift. Or on a snowmobile or cross-country skis; in a wintry stadium, an ice-fishing shelter, duck blind; or almost anywhere any time of year when you feel like an icicle in the making. Downhill ski clothes are fine for an active sport, but extras are needed when exercise can't control a chill.

Fingers, feet and face are the first to feel like ice cubes as blood circulation to them slows to go instead to your central core. Thin metallic sheeting like that used in spacesuits can reflect back body heat that would be lost. Thermos All-Weather Blankets and the Hand-warmer gauntlet gloves from Comfort Products, Box 9200, Aspen, Colo., use this type of material. In addition, the \$100 Handwarmers, designed by engineers of

the Apollo space program, have a heating element and rechargeable power unit in each glove that are regulated by flipping individual switches. Much less expensive is air—acting as insulation between several layers of gloves. Nylon or silk gloves topped with wool knit gloves or mittens under leather mitts are available from camping and climbing gear shops. These triple layers, like face masks and frostbite prevention creams, do not create heat but help retard loss of it from the body.

Hand and pocket warmers like the catalytic liquid fuel Optimus and Jon-E models, the Stag Hotstik solid fuel burner, the Scotty reusable-chemical hand and back belt warmers from Scotty Manufacturing and the battery-heated Lectra-Mits and Lectra-Pad body belt by Timely Products all worked well in our field tests, although exact heat control was sometimes difficult.

Unlike hands, it's harder to tuck your feet into your pockets or under armpits to keep them warm. Like hands, feet should be well shielded from the cold with protective layers. One or two pairs of socks and well-fitting quality boots—leather, fabric, rubber or a mix according to expected wetness—are a good beginning. Battery-heated Lectra-Sox from Timely Products, Fairfield, Conn., are about \$12. Hot Foot, San Diego, Calif., has electric insert soles at around \$25 a pair, and Comfort Products' Footwarmer soles with rechargeable belt pack are \$49.50 for regular models and \$84.95 for fitting into ski boots. These foot heaters, we found, can make a tremendous difference in cold-weather comfort, but expect them to be too hot or cold until you get used to adjustments.

Layering for body warmth is not new and should start with regular, net, thermal or quilted underwear according to conditions. Most snowmobile companies make one and two-piece suits in colors to match their machines, or you can choose PolarGuard lined suits like the Midwest Outerwear models we selected here. Down is still the most efficient—and expensive—insulating material, but Fiberfill and PolarGuard rival it, and are superior in wet climates. But if you plan to climb Everest or winter-camp on McKinley, expedition wear with a five-inch loft of goose down is the answer. ★ ★ ★



**Hand warmers**, created by Comfort Products engineers who helped design astronaut clothing, charge overnight, warm up after wrist switches are flicked on. Special lining also reflects heat. \$99.50.

**Chemical heat** is supplied from packets in Body Warmer belt by Scotty Mfg. Water activates it for five hours. Also shown are fishnet shirt, quilted underwear pants, belt battery pack for boot insoles, electric gloves.



**Cures for cold hands** include multilayer gloves and solid and liquid fuel hand warmers. All-wool knit gloves can fit into leather mittens. Stag Hotstik hand warmer holds solid stick fuel that burns for up to nine hours.







Warmth from the inside out now combines snowmobile clothes insulated with new synthetics plus electricity to heat hands and feet. One and two-piece snowmo suits by Midwest Outerwear are lined with PolarGuard. Gal's Frostline booties are filled with down and Lectra-Sox heat by battery. Handwarmer gloves recharge; insulated Royal Red Ball boots and Thermos All-Weather blankets hold heat in.

PM photos Cosimo



**Frigid feet** can be prevented or delayed with socks and insulated boots. New Royal Red Ball waterproof (left) has Thermo-Ply lining, zipper closure. Leather-top Red Ball can add felt liner. Field-boot Lectra-Sox from Timely Products use D cells.

**Slip-in soles**, from Comfort Products, can heat up boots, work shoes, waders, mukluks through wires from a belt pack that recharges overnight, delivers up to eight hours of heat, \$49.50. Ski Footwarmer, power unit and sole for each ski boot is \$84.95.





# Super thrill rides: They call them scream machines

The grand old roller coaster is roaring back—bigger, better, faster and scarier than ever.

by Norman Sklarewitz

**Passengers hurtle** upside down through 360° vertical loop at right, one of newest, scariest thrill rides. To top it off, cars make second pass through same loop—but this time going backward. Called the "Loop," ride was designed by Arrow Development Co. Photo below shows elaborate wheel system that holds cars on track from the top, sides and bottom.





**H**urling through space at breathtaking speeds upside down is a stunt you'd expect an aerobatic pilot to do, but now you can experience such wild sensations yourself—right on the ground—in a new generation of super thrill rides springing up at amusement parks all over the country. In them, you plunge down precipitous drops, do rolls and loops, pull Gs like a dive bomber pilot, even experience periods of weightlessness like astronauts.

Two of the newest and most spectacular are the "Loop" and "Corkscrew," both made by Arrow Development Co. of Mountain View, Calif. In the Loop, riders whirl through a 56-foot-high vertical loop, hanging head down at the top. For good measure, they then make a second trip through the loop—this time *backward!*

### Simple safety harness

The cars ride on tubular steel rails with wheel grippers on the top, sides and bottom to hold them safely on the track in any position. Passengers are kept snugly in their seats by a novel U-shaped, padded restraint bar that simply swings down over the shoulders and locks across the chest.

The Corkscrew is even more elaborate and spine-tingling. A 1250-foot-long spiraling track sweeps riders through 360° barrel-roll turns,



Vertical loop, spiraling turns, steep drops and a long tunnel section are features of this 3657-foot, 50-mph ride at Magic Mountain park in Valencia, Calif.

subjecting them to 1.2 Gs. As with most roller coasters, the only power used is to haul the cars up to the starting point, a 70-foot-high tower. Once over the top, the cars free-fall, reaching speeds of 45 mph. First installed at Knott's Berry Farm at Buena Park, Calif., the stomach-churning run has already attracted more than 2 million customers in less than two years of operation.

A variation of the barrel-roll ride is "The Turn of the Century" at Marriott's Great America park in Santa Clara, Calif. Like the Corkscrew, it slams passengers through head-spinning, spiraling loops over a 2190-foot course, starting from a

*(Please turn to page 154)*



One of most spectacular, this "Corkscrew" (above and facing page) puts riders through series of twisting, turning barrel rolls along 1250-foot run. Also made by Arrow, it is shown at Knott's Berry Farm in Buena Park, Calif.



Twin roller coasters race each other on parallel tracks (left) at this unusual installation called "The Rebel Yell" at Doswell, Va. Speeds reach 60 mph. Above is "Screamin' Eagle" at Eureka, Mo., said to be longest, highest, fastest run in the world.





# RETURN OF THE MODEL A: Running boards and

This famous Ford is being built again—in a little shop in Connecticut.

**A**bout the only thing in common between the original Henry Ford and 23-year-old Kevin Biebel is that both had an affair with the Model A Ford.

But Henry, you remember, ran off with a young dazzler called the V8 in 1932, while Biebel remains true blue, building in Stratford, Conn., brand-new and virtually handmade Model A roadsters that are so authentic they can be registered officially as 1931 Fords.

Henry's apparent fickleness stemmed in part from his never quite getting over the hurt that his beloved Model T (of which he built 15 million before production was halted in 1927) had become yesterday's bananas, and from the realization that the Model A could never take its place in his affections. Biebel's fidelity, on the other hand, stems from a fond and shrewd awareness that there is life in the old girl yet. And

both were and are right; the world took to Henry's new love in spades, and Biebel's sweetie is knocking 'em dead whenever and wherever she's seen.

And be assured a spanking-new Model A roadster is something to see, a car guaranteed to stir the nostalgic juices of anyone over 50, and/or delight the fancy and please the eye of anyone who appreciates that there was a time when cars were cars rather than appliances, mobile extensions of living room comforts, or zoomy expressions of self-proclaimed virility. Biebel began building them earlier this year.

## A passion for vehicles

Proprietor of a three-full-time-employee (himself included) business called Lordship Antique Auto, Inc., he has been rebuilding and restoring antique, classic and special-interest cars for several years, an outgrowth

of a passion for wheeled vehicles that he claims seized him at about age 5.

He began restoring his first car—a Model A—in after-school hours when he was 13. By age 15 he was in the business of refurbishing and selling old parts and making and distributing reproduction hinge post, door post, rear-view and fender mirrors for the old-car enthusiast market, most of his product line being aimed at a burgeoning Model A cult.

In the meantime, his restoration business continued to grow to a point where it overshadowed the parts and mirror business, so he sold off the latter and incorporated himself at 17 as a full-time restorer. He has been at it ever since, numbering among his accounts several of the nation's foremost private collections of old cars. Wisely, however, as it turned out, he continued to scout and stockpile Model A components.





# rumble seats

by Bill Kilpatrick

"When we got into this business full time," Biebel says, "we were small potatoes and sort of young, so not too many people were going to give us a crack at the really expensive cars. But we did our best on what we had to work on, and we must have done pretty well because when we started to hit the car shows, people began to pay attention, particularly to a couple of Model As we'd done, both of which turned up national prizewinners."

## Orders start to roll in

Biebel's reputation as a Model A wizard began to grow, and one day last fall a wealthy client, cash in hand, approached him with the idea of building what in effect would be a brand-new car. It was a thought Biebel himself had toyed with for years, and the up-front money pushed him over the edge; the car was built in a few months and is now tooling



1931 Model A Fords are being built today at Kevin Biebel's Lordship Antique Auto in Stratford, Conn.

About 85 percent of the car is original, made of all reconditioned parts, and the other 15 percent made of exact-scale, perfect replica parts done off the original Model A. Shown above are the front left wheel and suspension.

At right, from top to bottom, are the gearbox with shift lever; the body, which is done in fiberglass right down to the rivet heads; and a nearly complete Model A which is authentic enough to register as a 1931 Ford at state motor vehicle bureaus.



saucily around the Oregon countryside.

"The client liked the car and so did we," Biebel says. "A lot of people saw it and we began to get letters and telephone calls asking us if we could build more. We had most of the stuff we'd need on hand, so we figured what the hell, why not?"

Biebel says that original basic body shells and certain body components for the Model A roadster are hardest to find, meaning that if he ever hoped to get any kind of production scheme going, he'd need reliable sources of supply. His search for a body shell for his first new Model A brought him to an Oregon company known as Westcot Auto Styling, which could turn out—quite slowly, to be sure—a fully wooded and exact fiberglass replica of the original.

"The body they make is so authentic," Biebel says, "it even shows on the firewall traces of the crack made where the steering column went through, something I've seen on every Model A I ever worked on. The body is perfect in every detail, even to every last rivet head used in the original."

## Some parts hard to get

Biebel says other parts and components are readily available, mostly through specialty shops. A notable exception, however, are '31 radiator shells.

"They're rough to find," he says. "You can get all the '28s, '29s and '30s you want, but the '31s are few and far between. Fortunately, I've got a pretty good supply on hand, but if this new car thing takes off the way it looks like it might, we'll have to think of something."

With one or two exceptions, the most notable being the dash panel, which is made in West Germany, the parts and components used in making the Lordship Model As are either originals or U.S.-made reproductions. All of the original stuff used is completely reconditioned, and in some cases this means it is better than new.

"Not to take anything away from  
(Please turn to page 152)



# Old cars never die... they

Detroit's old, hand-me-down body dies are still stamping out 'new' cars.



1976 Brazilian Galaxie 500 started life as a 1966 Ford.

**T**he 1966 Ford is still being manufactured today in Brazil. Brand-new 1968 Chevy IIs are alive and well in Argentina, being built there as 1976 models every working day. So are any number of other outdated American cars.

Detroit's hand-me-downs serve a useful purpose in foreign lands. What happens is this. As body dies become outmoded here, they're sent to other countries. Tooling and die costs were amortized long ago during each car's U.S. run. Since automobiles tend to be very expensive anyway in places like South America and Spain, using hand-me-down body dies helps reduce prices. You can imagine that with newly created dies, tools and fixtures these cars would be more expensive still.

To go along with these second-time-around bodies are Detroit-developed engines and running gear. The Chrysler Corp. Slant Six is very popular abroad, as it still is here. So is the MoPar V8. And Chevrolet Sixes and V8s power not only the Argentine Chevys but similar cars in as wide-ranging places as Australia, Germany and South Africa. (The bodies for these latter cars aren't hand-me-down, but the engines are the same as we use here.)

To get to specifics, here are some

of the familiar ex-Detroit models still being manufactured today in different parts of the world.

## Brazilian Fords

Ford's 1966 full-sized sedans are produced today as the 1976 Brazilian Galaxie 500 and Ford LTD. These cars use the 292-c.i.d. V8 (discontinued here in 1962), the only change from previous U.S. specs being a Vasconcelos two-barrel carburetor. The Galaxie 500 and LTD are sold only as four-doors. Ford-O-Matic, airconditioning and vinyl roofs are among the Brazilian Ford's options. The Galaxie 500 retails for about \$10,000 U.S. in Brazil, and the LTD Landau goes for \$12,640.

## Brazilian Dodges

Brazilian Dodges are derived from the 1970 U.S. Dodge Dart. They come in four basic series: Dart De Luxo coupe and sedan, Dart SE coupe, Dart Gran coupe and sedan, and Charger R/T coupe. All span the 111-inch wheelbase, and their standard engine is the 318-c.i.d. V8.

Three-speed manual transmission is standard, with Torqueflite automatic optional. Other options include twin exhausts, power steering, heavy-duty suspension and metallic paints. The Charger R/T coupe can

be ordered with a 215-bhp version of the 318 and burns 82-octane fuel.

## Argentine Chevrolet

Chevrolet sent its 1968-69 Chevy II body dies to Argentina several years ago, and Chevys IIs have been produced down there ever since.

Called Chevy Standard, Super, Malibu, and Series 2, their base engine is the 230-c.i.d. Six, with 8.1:1 compression ratio and 137 bhp. On the Chevy Standard, a three-speed manual transmission is standard, the only accessory being power brakes. The Super has a more luxurious interior and comes with an optional 250-c.i.d. Six. The Malibu is again one step up, and a three-speed automatic is optional. For the faster crowd, the Series 2's Six is boosted to 170 bhp, with four on the floor, reclining bucket seats and console, plus fancy wheels and paint stripes.

## Argentine Dodges

Dodge might be discontinuing the Dart in this country for 1977, but not in Argentina. There, the 1970 U.S. Dart body shell is proudly offered in two series: Polara and Coronado. Both are on the familiar 111-inch Dart wheelbase. There's also an Argentine Dodge GTX

(Please turn to page 160)



# show up in foreign lands

by Michael Lamm WEST COAST EDITOR

DETROIT

MEXICO CITY

Brazilian Dodges for 1976 are (from top to bottom) Gran Sedan, Charger R/T and Sedan De Luxo—all of which derive from the 1970 Dodge Dart. They are all on a 111-inch wheelbase and their standard engine in Brazil is the 318-cu.-in. V8.



Dodge 3700 sedan and Spanish Jeepster, with hardtop shown on and off, are above. Both vehicles are made in Spain and are the latest models, even though the 3700 started life as a 1969 Plymouth Satellite sedan and the Kaiser (AMC) Jeepster stems from the '72-'73 Jeepster that was made here.



RIO DE JANEIRO

BUENOS AIRES



Argentinian Dodges: above, GTX and below, the R/T, both from '68 Belvedere. At bottom, the Dodge Coronado from the '70 Dodge Dart.



1968-69 Chevy II body dies have been in Argentina for several years stamping out various models, including the Series 2 above and the Standard at left. Base engine is the 230-cu.-in. Six, and three-speed manual transmission is standard.





**T**his engine is so quiet I can't hear it at any speed," croons a Denver service rep. "Very smooth and quiet."—Virginia accountant. "Less engine vibration than the six-cylinder 1974 Gold Duster I traded for the Arrow."—Florida design engineer. "The counterbalance shaft makes it a smooth, quiet motor."—Iowa salesman.

Plymouth's Arrow, like Dodge's Colt, comes from Mitsubishi in Japan. And like the Colt, it's available with Mitsubishi's **Silent Shaft engine**, an in-line Four with two counterweighted, counterrotating shafts that cancel out normal four-cylinder vibrations. It's not a new idea (the 1932 Pontiac V8 had a similar device), but it surely works.

Economy ranks No. 1 as the Arrow's main selling point and brings raves from 60.5 percent of its owners. A California merchandiser exalts: "Outstanding total economy in terms of initial price, maintenance, fuel consumption, etc." An Illinois hardware clerk: "It gives good gas mileage, looks sporty, was inexpensive, lots of standard features." A California lathe operator: "Looks nice, the price is not too expensive, and you can fill it with **regular leaded gasoline** because it doesn't have a catalytic converter." And an IBM engineer in Tennessee: "I wanted an economy car and liked the looks, price and warranty; also the fact that the Arrow is backed by Chrysler rather than a foreign company."

Workmanship and general quality also won high praise, 50 percent of our respondents

Several owners compared Arrow quality to BMW, Mercedes, Cadillac.

Counterbalanced Silent Shaft is available only in the 2000-cc engine.

People taller than about 5-foot-6 can't sit up straight in the rear seat.

Here's an economy feature that attracted quite a few Arrow buyers.

rating it no less than excellent. A Virginia realtor comments, "In my opinion, this Arrow has the quality construction that Volkswagen once offered in the late 1950s." Confirms a New York toxicologist: "Very solid; no shakes, rattles, or mechanical difficulties. I'm familiar with mechanical dependability of previous Mitsubishi products. The only problem is ill-fitting rugs."

Agrees a Los Angeles cable TV serviceman: "I can't find even one loose screw!" An Illinois steelworker: "Excellent workmanship, and it's the only car I've ever owned on which, if you let go of the door, it will shut without slamming. The Japanese have built a very solid little car. Everything fits perfectly."

On the minus side, though, low headroom bothered 10.4 percent of our owners, and 15.8 percent brought it up as one of the items they'd like to see changed. "The car's appearance, which I find attractive, was determined with the aid of a wind tunnel, I'm told. I believe that accounts for the **lack of headroom in the back seat**."—California bank clerk.

Other complaints involved the Arrow's seats. "The front bucket is too short to support my legs."—Indianapolis musician. "I'm 5-10 and wear 32-inch pants. I must drive with the front seat all the way back. My knees are still bent, and there's no room for anything but midgets in the back seat."—New York ice cream man.

Styling capped the buying decisions of 54.9 percent of owners surveyed. A Califor-





**PM OWNERS REPORT:  
PLYMOUTH ARROW**

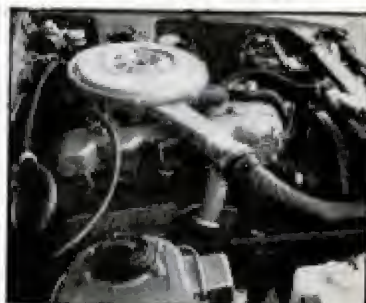
## **Bull's-eye on styling; near miss on headroom**

A nationwide survey based on  
823,552 owner-driven miles

by Michael Lamm WEST COAST EDITOR



Arrow interior (left) is less than perfect for some owners. Lack of head and legroom is a complaint, and seat style and shape is another. Two-liter Silent Shaft Four (below) is praised as is Arrow's nimble handling (bottom).



PM Photos; Irv Dolin





nia police sergeant comments, "It was the best-looking small car I could find at the time, and the price was right." A California nurse: "My husband wanted us to buy a sedan, and I wanted a station wagon, so we compromised on this Arrow hatchback." A Minnesota law student: "Hatchback styling gives good looks plus good storage space for such a small car."

Performance pleased owners with the 2000-cc engine but displeased others who chose the 1600-cc. Generally speaking, the five-speed overdrive transmission brought smiles while the Torqueflite automatic fostered a few grimaces about sluggishness. On performance, a San Diego student writes, "Has fantastic power; the pickup is there when you need it. Clutch is very, very light, and the five-speed tranny responds quickly, although reverse requires some effort to get in gear."

Handling again brought favorable comments from owners who mentioned it. A Milwaukee secretary burred, "I like the feel of the car, the way it handles on the road. Sure is a change from a big car." A Wisconsin auditor: "I replaced a Triumph Spitfire and especially like the Arrow's performance and handling."

Dealer conscientiousness and service received mixed reviews, most owners judging their dealers *good to excellent*. One item that tipped many a buying decision was the Arrow's 12-month, unlimited-mileage warranty. One Minnesotan mentioned, "I drive 300 to 400 miles a week. After comparing most small cars in the Arrow's price range, the unlimited-mileage warranty proved the turning point for me."

Two-thirds of our respondents had experienced no mechanical problems with their Arrows, and the other third's primary complaint was brake squeal—no great problem. Hesitation and engine surging plagued 13.8 percent, a trait traced to the carburetor.

Suggested improvements and changes in the Arrow's overall makeup included these: "The average driver's view of the road is

Good idea—that way there's space for a mix of cargoes.

The five-speed overdrive trans is available with the 1600-cc engine.

partially blocked by the inside mirror. I have to bend down to see past it."—Illinois businessman. "More headroom in the rear."—New York secretary. "Parts should be available when a new car is put on the market. We've waited two months for touch-up paint and a lamp bulb in the radio."—New York super. "I'd like to see the rear seatback split so you can fold down half at a time."—South Carolina banker.

In summary, the Arrow does everything promised and pleasantly surprises many owners with its performance, handling and riding comfort. Tight rear head and legroom come as no surprise to most buyers, and hatchback convenience more than compensates. Quality, workmanship, and tossed-in extras leave owners really impressed. ★★



Rear seats are very tight, lack headroom for anyone over 5-foot-6. Auto Editor Hartford (left) is 5-9. Seat folds easily (above).



Versatility of the hatchback design (left) is an Arrow feature much liked by all owners. The back seat folds down to increase luggage space.

## Summary of 1976 Plymouth Arrow Owners Reports\*

Total miles driven	823,552
Average miles per gallon:	
1.6-liter Four	
In town (EPA, 23 manual)	25.3
Long trips (EPA, 32 manual)	32.2
2.0-liter Four	
In town (EPA, 18 manual)	22.0
Long trips (EPA, 31 manual)	28.6
Engines:	
1.6-liter Four	52.9%
2.0-liter Four	47.1%
Transmissions:	
Five-speed manual	40.5%
Four-speed manual	33.8
Automatic	25.6
Models:	
160 series	36.2%
GT	34.5
GS	29.3
Why did you choose the Arrow?	
Styling	45.0%
Economy	51.8
Size	20.3
Price	13.2
Specific likes:	
Economy	60.5%

Styling	54.9
Handling	44.4
Comfort	19.5
Ride	13.3
Specific dislikes:	
Not enough headroom	10.4%
Short on legroom	9.4
Rattles	7.3
Poor dealer service	6.3
Lack of power	6.3
What changes would you like?	
More headroom	15.8%
More legroom	7.4
Reshape seats	5.8
Better materials	4.7
Dealer sales opinion:	
Excellent	36.0%
Good	37.1
Average	16.2
Fair	5.6
Poor	5.1
Workmanship opinion:	
Excellent	50.0%
Good	37.4
Average	8.6
Fair	2.0
Poor	2.0

Comfort opinion (front seat):	
Excellent	39.4%
Very good	44.4
Good	11.1
Fair	4.5
Poor	0.5
Comfort opinion (rear seat):	
Excellent	6.7%
Very good	10.9
Good	20.1
Fair	33.2
Poor	27.2
Number of vehicles owned:	
Arrow only	39.0%
Two cars	47.0
Three cars	9.0
Four cars	2.5
Five or more cars	2.5
Makes of other cars owned:	
Plymouth	29.5%
Dodge	12.2
Chevrolet	12.2
Ford	11.4
Pontiac	7.3
Had any mechanical trouble?	
No	66.7%
Yes	33.3

What type of trouble?	
Brake squeal	10.5%
Airconditioning	13.8
Carburetor	13.8
Electrical	9.2
Cold starts	9.2
Did you fix it yourself?	
No	70.9%
Yes	9.1
Dealer repairs satisfactory?	
No	53.6%
Yes	46.4
Dealer service opinion:	
Excellent	24.3%
Good	32.4
Average	21.4
Fair	9.2
Poor	12.7
Age distribution of owners:	
15-29 years	56.0%
30-49 years	28.3
50-plus	15.6
Would you buy another Arrow?	
Yes	76.2%
No	23.7

\*Percentages might not equal 100% due to rounding or insufficient data.





### Solar electricity from wafers

Domestic electricity from the sun may soon be feasible, using new solar cells that produce 1000 times more energy than the same size array of silicon cells now powering satellites. Engineers at Varian Associates in Palo Alto, Calif., are testing tiny gallium arsenide wafers with a sun-tracking parabolic reflector that concentrates light on the wafers to generate power. Small-scale prototype above puts out 1 volt at 10 amps., but a 100-cell array could produce a kilowatt. (For more on similar research, see *MIT Breaks the Sun Barrier*, page 54, Sept. '76.)



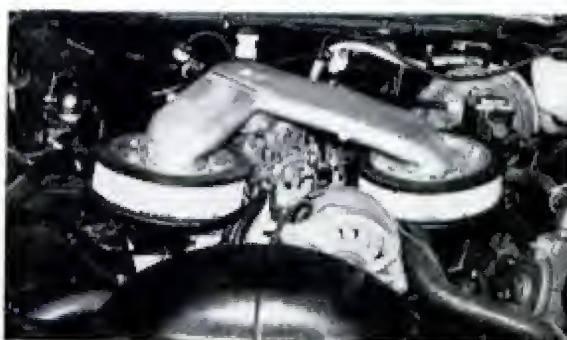
### Quick cable mounts for masonry

Securing electric wire or cable to masonry walls no longer calls for masonry bits, anchor bolts and mounting clips. A new epoxy-applied mount sticks to concrete or masonry walls, and the electrical conductor is fastened in with a quick cable tie. The mounts come in black, weather-resistant nylon for outdoors; natural nylon for inside and can be used with TV, hi-fi, telephone or electrical cable. They are designed for use with EMA epoxy, which provides a pull-off force exceeding 50 pounds. Panduit Corp., 17301 Ridgefield Ave., Tinley Park, Ill. 60477, makes the glue-on mounts.



### Bank stick-up alert

One problem in bank holdups has been to alert street police and passersby that trouble's afoot. Now New York's Chemical Bank has a sign outside each branch which, when activated by hidden buttons, flashes a "Robbery in Progress" warning to people and the cop on the beat. Hope is people will duck, clearing streets.



### Hydrogen-powered car

It looks like a '75 Pontiac—and is, engine and all. But the conventional 450-cu.-in. plant has been converted to operate on pollution-free hydrogen. Top photo shows engine modification involving a propane carburetor, redesigned to mix hydrogen with air instead of propane. Shielded ignition cables reduce induction to prevent backfire, and water injection has been added. Bottom photo of trunk shows fuel tank containing powdery metal hydride which soaks up hydrogen fuel and carries it in safe form. The hydrogen is released from its chemical bonds only when heated by engine exhaust. Should tank rupture in an accident, spilled powder would not ignite or explode. The system, devised by Billings Energy Research Corp. of Provo, Utah, currently is being tested in a bus fleet.



# Motorcycling mean streets

Some streets are no place for a street bike! But the 175 enduro is a natural for both on and off the road riding.

by Jim Elder

**S**treet riders often have to cope with off-road conditions. Big-bikers, especially, have to learn to live with the downers of steel bridges slickened by rain, loose sand and gravel on the road, road construction, railroad tracks, wet leaves and all other terrors associated with large motorcycles and street tires. Five hundred pounds go down hard when they go down.

Nobody is suggesting you hang a headlight on a motocrosser for a cross-continent vacation ride on the odd chance that you might hit one angled two-by-four on a freeway exit in Iowa. But for short-distance commuting, running errands and low-mileage weekend recreation, do you really need a superbike? The alternative is not necessarily a moped or a 100-cc pussycat. Even with the 55-mph speed limit, freeway traffic demands quick throttle responses and 60-plus cruising capabilities. Where do you look for a four-lane commuter



**Rough riding** is in store when you encounter road construction (as shown top right), detours or just plain chuckholes. Hit a flooded section of road (above) with a superbike and you'll be swimming, but with high clearance and trials/universal tires, it's more like fun.

**Versatility** is another advantage of a medium-sized, 175 enduro: just bungee a box on the back and you can haul home the groceries.





which will also ignore manhole covers, a bike that will carry you and the groceries over torn-up suburban streets on Friday afternoon, two-lane blacktop or on one-line dirt cow-trails? Look at the enduros.

You may have no intention of racing the Baja or spending a day slog-ging through mudholes and up mountains from checkpoint to check-point. But the design qualities that make good enduro motorcycles—speed, handling, responsive suspen-sion, light weight and street-legal lighting—might also make an ideal transportation and recreation ma-chine.

### How many horses?

A 175 has just enough extra mus-cle to minimize shifting, but tame enough to wheelie only when your whim, not the bike's, wants some daylight under the front tire. Mod-ern 175s deliver 16 to 25 horses to the driving wheel.

A dozen, maybe more, manufac-turers offer street-legal enduro ma-chines in the 175-cc class. Best-known and most widely distributed are the Yamahas, Suzukis, Kawa-sakis, Hondas and Harleys.

All 175s are single-cylinder kick-starters. Fifty-two to 55-inch wheel-bases mean they are full-sized adult machines, but the low, 200-pound weights mean trim ladies and skinny guys can flick them through low-speed traffic and pick them up when some turkey knocks them down in the supermarket parking lot.

That suggests another plus for en-duros. An upset, while you are in buying groceries or out jumping logs, will not bankrupt you. These motorcycles are designed to take tumbles with no more damage than perhaps a broken mirror or a turn-signal lens.

While we are talking money, en-duros sell for \$900 to \$1500—half the bite of big bikes. For insurance, figure twice to three times the pre-mium for liability-only on a big-dis-placement machine, and three to five times more for full coverage. The 175s are stingy with parts and ser-vice, of course, and easier to work on if you like to do your own wrenching. Fuel economy compari-sons are less spectacular. The one-lung enduros drink sparingly, but they like oil through those two-stroke engines. Don't bother to count the pennies either way—just com-pare any motorcycle's liquid appe-tites with the four-wheel alterna-tives.

### Two rides and a wring-out

We don't pretend to have tested every 175. But to support our thesis that an enduro of moderate displace-ment deserves consideration as a commuting/recreation motorcycle, we rode two of the latest models and gave one a two-year, 5000-mile wring-out.

Nine bills will buy the Honda XL-175, a happy genetic cross of Honda four-cycle smoothness and the Elsi-nore motocross handling. The Japa-nese thumper is polite and predict-able on the highway, all the way up to an honest 70 mph. Good balance and 8-plus inches of crankcase clear-ance mean you can jump a curb when the clod in the dump truck pulls an unannounced left turn in front of you, or jump the downed tree on your favorite weekend trail.

The turn signal lights are stuck on tiny stalks which may be pretty but not after one fall-down. And like most Hondas, the XL is cold-blooded every morning, but that is what chokes are for.

Kawasaki put new fenders and a

rerouted pipe on the quick and de-pendable F-7 and now call it the KE175. "Super-lube" mixes the oil, the engine delivers 16 hp at seven grand and it does have a tach. It has an inch more ground clearance and eight pounds less weight than the Honda, for about the same price. Front turn lights are rubber-mount-ed on the bars, but the rear blinkers will self-destruct as quickly as those on the XL.

There is more to say about the Can-Am T'NT. You would expect as much since we spent two years in the saddle on that bike and found out a lot about it in that time. It has the longest wheelbase—55 inches—of the 175s, 9-inch clearance and weighs 233 pounds. It carries 2.5 gallons of gas, seven-tenths more than most, and the metered-injection oil reservoir is part of the upper frame member.

### Prebreakfast warmup?

The T'NT has been in daily three-season use for two years. It has been driven on several 112-mile highway trips which included two high moun-tain passes and one long straight where 80 mph could be sustained before Idaho began enforcing the new speed limit. One time it covered 300 miles of the Oregon Trail—over sand, shale, rocks, sagebrush and rivers. Perhaps a prebreakfast warm-up for a California desert racer, but three tough days for one who is normally a road-biker. It's hauled groceries, gone fishing and carried cameras to places no four-wheel-drive would go.

It spent six weeks touring the East Coast tied down behind a van most of the time, which blew the fork seals. After installing new rubbers and new fork springs just in case, the only problems have been unde-pendable charging of the battery, which only affects lighting when the engine is shut off, and one burned-out headlight which was replaced with a domestic sealed beam for one-fourth the cost of the Austrian original.

### Rear rack helps

For touring and commuting ver-satility, a rear rack was installed and an Eclipse tank bag was strapped on. Since much of the riding was in heavy summer traffic, a right-hand mirror was added, but both come off for back-country travel. Riders from 14 to 46 have found the rangy frame comfortable and controlla-ble. Perhaps the 30-inch seat height, two inches lower than some enduros, helps the younger riders, while the longer wheelbase doesn't cramp a

(Continued on page 166)



Suspension, balance and tires of an enduro make cattle guards, railroad tracks, bridge joints and other potential pitfalls (left) a breeze. You can use an enduro as a practical, around-town commuter bike and, as shown above, ride into the sunset on back roads and trails.



**C**itizens' band radios have become the hottest items in "hot" merchandise. They're small, but valuable. They're in demand, and—left alone so often in unattended cars—they're all too easy to steal.

Think about the CB in your car for a moment. You probably have a big, distinctive antenna advertising the fact that you have a radio worth stealing (some thieves find the antennas worth stealing, too). And the average curb-side thief can usually spot that radio's location with a quick glance through your car's side window, then pry it out and run off with the CB in about as little time as it takes him to break into your car.

And a break-in can cost you not only your CB but whatever else of value there is in your car—plus the cost of fixing any damage.

But make it a little harder for a thief to find and steal your set, and you'll keep it a lot longer. And, responding to the rise in CB thefts (State Farm Mutual Insurance estimates nearly one-fourth of its 1975 auto accessory theft payments went for CB radios), manufacturers are

flooding the market with gadgets designed to avert thefts.

### Your antenna needn't advertise

A CB antenna on your car is very "in" these days. You can even buy a dummy to "give your car that 'CB' look." But keeping that antenna in the car, where it won't betray the presence of a CB, is better. An intelligent thief (and the really dumb ones don't last long) would rather make a beeline for the car with the 108-inch whip than walk up and down the aisles of a parking lot looking through car windows to spot a car with a CB inside. The beeline approach is less likely to attract suspicion—and it's less work.

The simplest way to foil a thief is to remove your antenna whenever you leave your car. That still leaves a

telltale socket, but it's not visible from as far away as the antenna was. Antenna Specialists and Radio Shack make quick-disconnects that let you remove your antenna with a simple push and twist. (But so can a thief, so be sure to take it off when you park.) You can also just unscrew the mast, but that takes longer; if you do, it's wise to keep rain and dirt off the now-exposed contacts with one of the little plastic caps made by Antenna, Inc., Antenna Specialists and Radio Shack; buy extras—they're easy to lose.

### Folding antenna brackets

An easier approach, if a bit more expensive, is to buy one of the many brackets that let you fold your antenna down into your trunk when you park. Most of these attach to the lip

**Rugged lock-mounts**, like this Shur-Lok, can protect your set—if anchored well enough that no one steals the whole assembly.



# How to end the CB ripoff

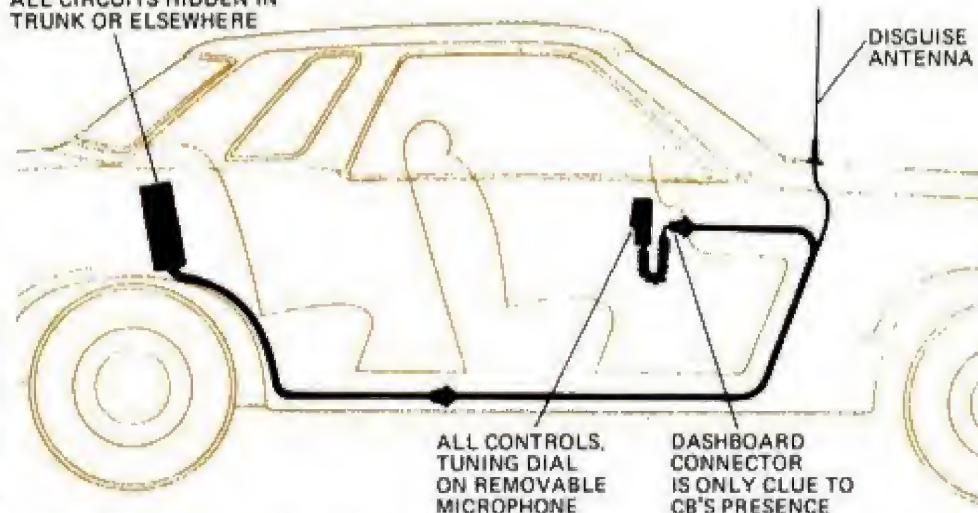
by Ivan Berger  
ELECTRONICS EDITOR



Hide the fact you've got a set: Hy-Gain 9 (below) has all its controls, plus a digital channel readout, on its microphone, with the rest of its works in a featureless, and easily hidden black box. With optional extension cables, you can even hide the box in your trunk—yet still have all controls near the driver (right). If you remove and hide the microphone when you park the car, and use a Hy-Gain or Antenna Specialists disguise antenna, no one will know you have CB.



ALL CIRCUITS HIDDEN IN TRUNK OR ELSEWHERE



(\$30) solution. It looks like a normal AM-FM antenna, and doubles as one, too. But like the retractables, it must be mounted asymmetrically, and is also about 3 dB less efficient than conventional antennas. The makers say there's no significant loss of AM or FM reception, though. And the disguise antenna, unlike the fold-down or retractable types, must be unscrewed when you're going through a car wash.

Removable antennas are another answer. Magnetic mounts can be placed in the center of the roof for the most even radiation, and will stick on well beyond legal speeds on all cars but those with vinyl roof covers or convertible or plastic tops. For side mounting (and asymmetrical radiation again) there are many mounts that clip on a car's rain gutter. A new one from Channel Master clips to the edge of the side-window glass. Then there's the removable trunk-lip mount from Antenna Specialists.

#### "I don't see no set in there"

Even without "advertising," sooner or later someone will look in your car window and be tempted by your CB's shiny chrome. Or maybe they'll be looking for—but not finding—your set.

Out of sight, out of mind is what counts. So some CB owners install their sets in such spots as the glove compartment, under the driver's seat, or beneath the dash but way back near the firewall. The set's now out of sight, all right, but so are its controls.

That's one reason you'll find more and more sets with most or all of their controls on the microphone. Radio Shack's One-Handler puts them all there; similar sets from Royce and Midland leave a few on a small control box, which can be easily tucked into the glovebox.

But the set ideally adapted to this

approach is the Hy-Gain 9. Unplug its microphone/control head, and the only sign of the set's existence is the round black jack—easily concealed—that the mike plugs into. The rest of the circuits are in a featureless black box, which can be mounted almost anywhere in the car, especially if you use the optional extension cables.

Performance of this set is excellent, though its controls take a bit of getting used to (they seem to work backward). Its digital channel read-

surrounding the trunk opening, and let you open the lid and fold the antenna down inside. The one shown here, from Holly Enterprises, attaches to the trunk lid instead; it could be a bit handier when you're loading or unloading. Such brackets average about \$15 each; one—the SouthCom Foiler—is \$5.

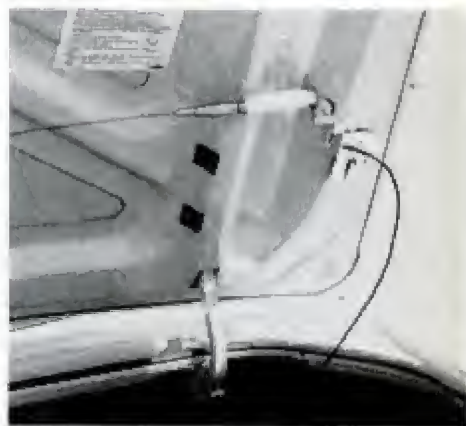
You can use any antenna with these brackets, as long as it's shorter than the width of your trunk opening (allow a bit for the bracket's height, too). But since you have to mount the assembly at the side of the opening, your antenna's radiation pattern will be asymmetrical, pointing diagonally across the car from its mounting point (see *How to Add the Right Ears to Your Wheels*, page 86, March '76).

If you don't want to stop each time you park to open and relock your trunk, you can get an electrically retracted antenna, like the Tenna model shown, or similar ones from Royal Sound, Kraco, Antenna Specialists, CPD, Metro Sound and Valor.

Since these must be mounted at the side of the car, they also radiate asymmetrically—and they don't radiate as well as regular antennas, either. Antenna makers estimate a loss of about 3-6 dB in signal strength, which they claim will not cause a significant reduction in range. And retractables cost about \$40 to \$70.

#### The 'disguise' antenna

Antenna Specialists' "disguise" antenna is a slightly less expensive



Swing the antenna into the trunk with this mount from Holly Enterprises. You don't have to break connections to do it. Similar mounts are available from many sources; most mount on the edge of the trunk opening, not the lid.





**Retract your antenna** and it won't attract thieves—or vandals, either. This model, from Tenna, is center-loaded. Many makes of retractable antennas are available, some of them doubling as antennas for ordinary AM and FM car radios.



**Mounted in your dashboard's radio slot**, a CB is harder to steal—and looks so much like a regular car radio that many thieves may not even notice it. But look up the microphone when you park—it can still be stolen readily.

out in the mike is easy to read. The only drawback inherent in this approach is that the microphone must double as a speaker. At moderate volumes, this works well, but at high volume levels, distortion is a problem. There is a connection on the black box for an external speaker, but that's one more wire to run and another component to conceal.

(By contrast, the microphone in Radio Shack's One-Hander was not nearly as good a speaker as the Hy-Gain's—but the big speaker in the One-Hander's main box was a far better one.)

### Steal your own set first

If you already own a set, you can hide it another way, with a slide-in mount that makes and breaks the set's connections for power, for the external speaker (if you're using one), and sometimes for the antenna as well (page 76, June '76).

This has an added advantage: If the bracket's visible and empty, it shows the set has been removed, which might discourage a would-be thief from hunting for it. If you've already stolen the set, he can't.

But there are also disadvantages: If you forget to take it out, you make a thief's job all the easier. And some insurance policies pay off only on thefts of sets which are rigidly mounted as "part of the car."

Once you've slid your set out, what then? You can tuck it under the seat (probably the first place a thief would look, though), hide it in the glove compartment (if it fits), or lock it in the trunk (best done out of sight of the area where you'll be parking your car). Or you can take the set away with you: Platt Luggage even makes a molded carry case just for that purpose.

Other mounts, such as the Shur-Lok, take the opposite approach. Instead of making the set easy to remove, they make it hard to take—hard enough, you hope, to discourage a thief's attempt. But unless the mount is anchored with great care, it can be ripped out and the set removed.

Mounting the set in your dashboard is a neater way to make it hard to steal. Combinations of CB, tape and AM/FM to fit your dashboard's radio slot are available from JIL, Royce, Boman/Astrosonix, Automatic Radio and Audiovox.

Combinations give you fewer controls to fiddle with, and place them all where they'll be handy. But they make you pay a lot—and all in one lump. If any part needs fixing, the whole system will have to be out for repair (and it's reasonable to suspect that cramming all that into one box

increases the chance of something going wrong). And the set's high value might tempt a thief into ripping up your dashboard.

### Alarms: the last resort

All these tactics are designed to convince a thief it's not worth his while to break into your car. But what if he does anyway?

Then your last resort—short of an armed guard in the car—is to rig your car with an alarm in hopes of scaring him off again before he has stolen anything worthwhile.

There are car alarms designed to ring, scream or blow your car's horn if the car is jostled or opened, or if your set or antenna is removed. But don't count on anyone's responding unless you're within earshot yourself. And alarms work best only if your CB is so well secured that a thief must spend a long time getting it. So consider an alarm as a supplement to other measures, not a substitute.

CB is still a hot item. But these precautions should help you keep cool about keeping yours. ★★★



**Cross a Kriket with a camel**, and you get a Kamel that sits on your car's hump, holds a Kar Kriket speaker for clearer sound and takes your CB. When you park, it transfers readily to your trunk. From AFS, it's priced at \$30.



# IT'S NEW **NOW**



## Wings for CB 'takeoff'

This distinctive design for mobile CB antennas features "wings" of rigid aluminum that mount on a car trunk. Makers claim performance equal to a 48-inch whip, due in part to capacitive top-loading. Channel Master, Ellenville, N.Y. 12428.



## Copper-clad mini-car

What do you do with 8517 old British pennies and a lot of spare time? In Carsigan, Wales, a young secretary applied that many king-size "coppers" with epoxy to the entire surface of her baby Austin. The dazzling finish weighs 150 pounds, has a face value of only \$60. But considering its unique application, the collection is said to be worth up to \$5000.



## Torchlight for corners

Flexible fiber optics allow a new mini-torch to bend light around corners for modelmakers or handymen. A junior "Lite Probe" uses two AA batteries, costs \$4. Industrial model takes two D cells in a plastic case (above), \$48. Ibis Overseas, Ltd., 520 N. Michigan, Chicago, Ill. 60611.



## Solar 'blanket' warms swimming pools

Fuel-fired pool heaters were fine before the energy crunch. But now you can raise your pool's temperature 10° to 15° with "The Solar Pool Blanket," a sheet of transparent plastic bubbles that let in solar heat, then act as insulation to prevent its escape. Makers claim it allows cold-weather swims with 70 percent less fuel cost. Dearing Solar, 12324 Ventura Blvd., Studio City, Calif. 91604.

## Message holder clips right to your telephone

"While you were out . . ." messages needn't get buried on paper-strewn desks any longer. The answer is a flexible plastic "Call-Back" message clip that snaps into the rear finger-lift notch of any standard business office or home telephone. The manufacturers have made it transparent so that it will blend with the color of any telephone or home decor. \$1.98, R & D Products, 2 E St., Santa Rosa, Calif. 95404.





# Lasers: new light on tomorrow's world

In 1960, the laser was still a lab curiosity. Today it's into everything from drilling teeth to machining the toughest metals. Tomorrow the laser may unlock the door to useful power from nuclear fusion reactions.

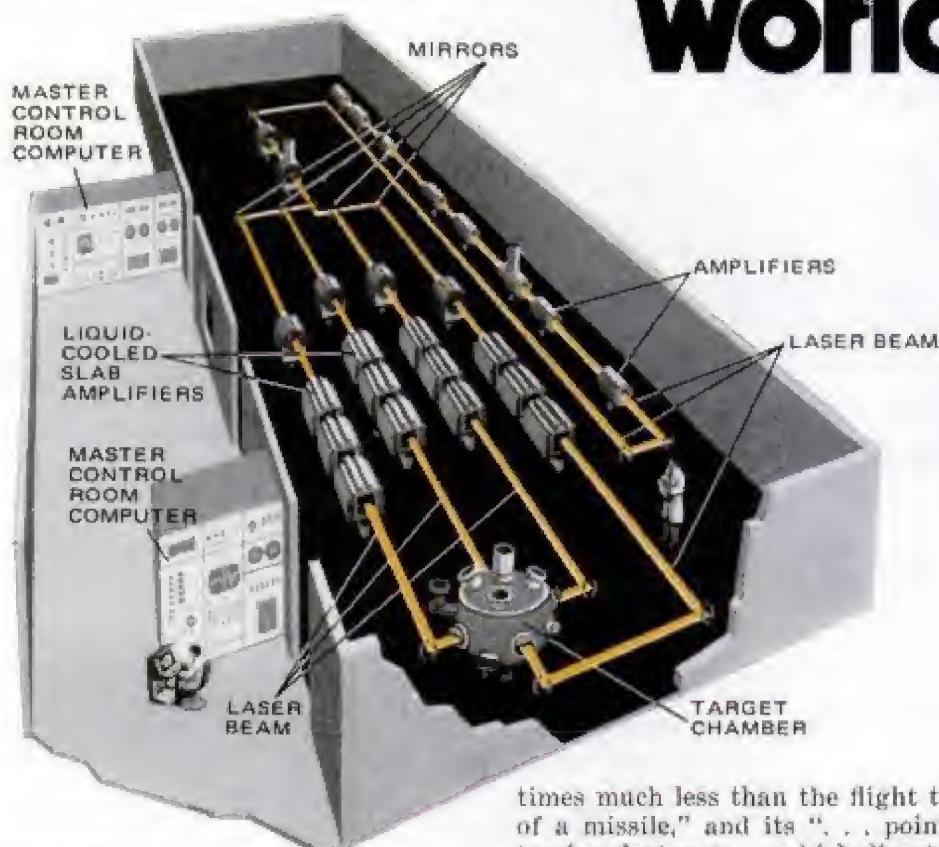
by Richard F. Dempewolff

**E**ven behind the dark glass shield a blinding pyrotechnic display spouted like a July Fourth fireworks fountain. In a split second I'd seen a sheet of  $\frac{1}{4}$ -inch-thick titanium—among the toughest metals in use—sliced in two at 580 inches per minute. The cutting tool was a toothpick-thin beam of invisible light.

At United Research Laboratories (URL) in East Hartford, Conn., that same beam—from a 15-foot-long carbon dioxide "electric discharge laser" (EDL) capable of delivering a continuous 20-kilowatt beam—has been cutting up or perforating everything from paper and ordinary lumber to stainless steel, foot-thick granite and even diamonds. It's been welding metals of all kinds—steel up to an inch thick. It's been melting cylinder walls and valve seats to provide them with a nearly indestructible ceramic-like surface, known to laser people as an "amorphous" or a "glass metallic" coating. And 20 kilowatts is modest in the high-energy laser business nowadays.

## Top-secret laser work

Just how modest is indicated by occasional hints seeping from places like our military's Defense Advanced Research Projects Agency (DARPA) and its sacrosanct laser weapons development branch at Kirkland Air Force Base in Albuquerque, N.M.—



**University of Rochester's laser** fusion lab hits a nuclear fuel pellet with four beams. A new lab will have 24 converging beams with 5000 times the energy.

with the cloak-and-dagger code name "Eighth Card." Here, as well as in nuclear fusion labs, laser power is discussed in terms of "megawatts" and "gigawatts" (millions and billions). Not that it's actually running that high except in an occasional burst for a billionth, or trillionth, of a second.

But that doesn't mean our national defenders aren't dreaming hungrily about such laser power. A recent DARPA report to Congress discussed the need to investigate laser rocket propulsion systems "for launching military payloads into space," and exploitation of the high-energy laser's ability "... to precisely transmit energy over very long distances at the speed of light." It talked about the laser's "... ability to cause damage to the target in

times much less than the flight time of a missile," and its "... pointer-tracker features ... which direct the laser beam spot onto a critical area of the target to do damage."

Actually, there's a big difference between a continuous laser and a nano-second (millionth of a second) power-packed zap, which will become evident as you read on. But today, the high-energy laser is at least a qualified fact.

Most of the early tales of Buck Rogers-type "death rays," capable of

**The ubiquitous laser** has moved into a variety of fields—from jobs calling for flea power less than a watt that pumps light signals through hair-thin optical fibers in the Bell System's lean cable (A), to the multikilowatt beam that drills precision holes through stainless-steel turbine fan blades (E). Today's high energies were made possible by Bell Laboratories' Dr. Kumar Patel and his invention—the CO<sub>2</sub> laser (B). Other applications involve "fingerprinting" of inclusions in gemstones (D). Experiments even use laser to clean tooth decay with a special "lightwave guide" (C).







vaporizing everything from people to whole cities, probably were prompted by the miasma of super-secrecy surrounding the Eighth Card operation. Dr. George Heilmeier, DARPA's director, has vigorously denied the existence of laser "super-weapons" on any U.S. planes, tanks or ships. He labels such reports absurd. The really far-out rumors probably are. But whether or not new high-energy lasers have been tested for weaponry potential on actual military heavy equipment is academic at best.

Lasers powerful enough to inflict significant damage to delicate components of enemy aircraft, satellites or missiles already have been demonstrated in scientific and industrial laboratories. And experimental high-energy mobile laser units packed into huge vans admittedly are being field-tested by military services for tactical uses—among them a Honeywell 1000-watt LADAR system (laser radar) for precision "antiship missile defense and missile guidance."

### Power for zapping planes

Four years ago the laser industry journal *Laser Focus* reported that wood was being set ablaze by a 60-kilowatt gas dynamic laser (GDL)

two miles distant, and that the beam could be aimed precisely enough to peg a playing card at a mile. Recently, Bell Laboratories' Dr. Kumar Patel, inventor of the high-energy carbon dioxide laser, told *Popular Mechanics* unequivocally that with current technology an infrared CO<sub>2</sub> laser has the potential size, efficiency and power to be packaged aboard a 747-type plane and to knock other planes from the sky "at long distances." And it's no secret that advanced lasers are steering large anti-tank gun projectiles to designated targets with near-flawless precision.

And there's been persistent talk from the field about a laser gun designed to blind enemy gunners from the air. GIs call it the "eye-popper." While officials won't acknowledge it, there's no question that any rifle-type laser device employed in ranging and tracking could be adapted to "eye-popping," given proper (and available) power and optics.

More interesting to gun sportsmen, perhaps, is an "Indoor Marksmanship Trainer," made by International Laser Systems in Orlando, Fla. Using a low-power "eye-safe" laser that adapts to the M-16 rifle, the unit shoots laser pulse "bullets"

*(Please turn to page 132)*



**A parade of lasers** (from top): An Army rifle-type ranging laser; a 20-kilowatt beam zapping oil shale; a laser-guided missile and target about to be hit; GTE Sylvania's mobile PATS tracks planes. Left, top: Laser target trainer with readout scope. Left: The Army's tracked test bed for evaluation of laser weapon.



# You can make giant prints at home

by Ivan Berger  
PHOTOGRAPHY EDITOR

**M**aking photomurals in a home darkroom isn't easy. But it is possible—and the results are quite impressive. Kodak enlarging papers are available in large rolls (Porter's in Cedar Rapids, Iowa, sells them by mail), and most enlargers can be tilted to project big images on the wall or turned around to project them on the floor.

For developing the big prints, there's lots of equipment available. Perhaps the least expensive are the Maxwell Photomural tanks that hold paper up to 30 by 40 inches (other sizes hold up to 48 by 96), develop them in just one quart of chemicals, and cost just \$25 up.

A more elaborate approach is the \$119 Big Dipper, which holds the paper under moderate tension while you raise one side and lower the other to pass the paper through the chemicals in the troughs below. It processes paper up to 30 by 50 inches, using only 32 ounces of chemicals, and gives you a view of the print's surface while it's developing. Four trays are included, one for each chemical plus a washing tray with hose attachments. There's also a \$30 Little Dipper; the difference is that the overhead hoist is eliminated, leaving you to pass the paper up and down by hand.

## Get a helping hand

For professional labs, CPI's Mural 2000 (\$865 without pump and motor drive) handles paper up to 5 by 35 feet! But the 5-foot trays are available separately for \$78 each, if you want to try hand dipping.

You'll find it helpful to have help when you're making murals—not just for handling the big sheets of paper (they get very floppy when wet, and wrinkles can crack the emulsion), but also for focusing: One of you can stand by the paper checking, while the other focuses. ★ ★ ★



Prints this size and bigger demand care in processing. New darkroom hardware makes it easier to do—and do it right.



Maxwell tank (above) is inexpensive, saves chemicals. CPI Deville machine (right) can be motorized, has temperature control system available.



Big Dipper is expensive (\$119), but its crank system makes it easy to roll the paper through the chemicals evenly.





# Snowmobile with everything

For driving over snow or camping out in it, there's new equipment that makes the sport more comfortable, more fun—and safer.

by Bill McKeown  
OUTDOORS EDITOR



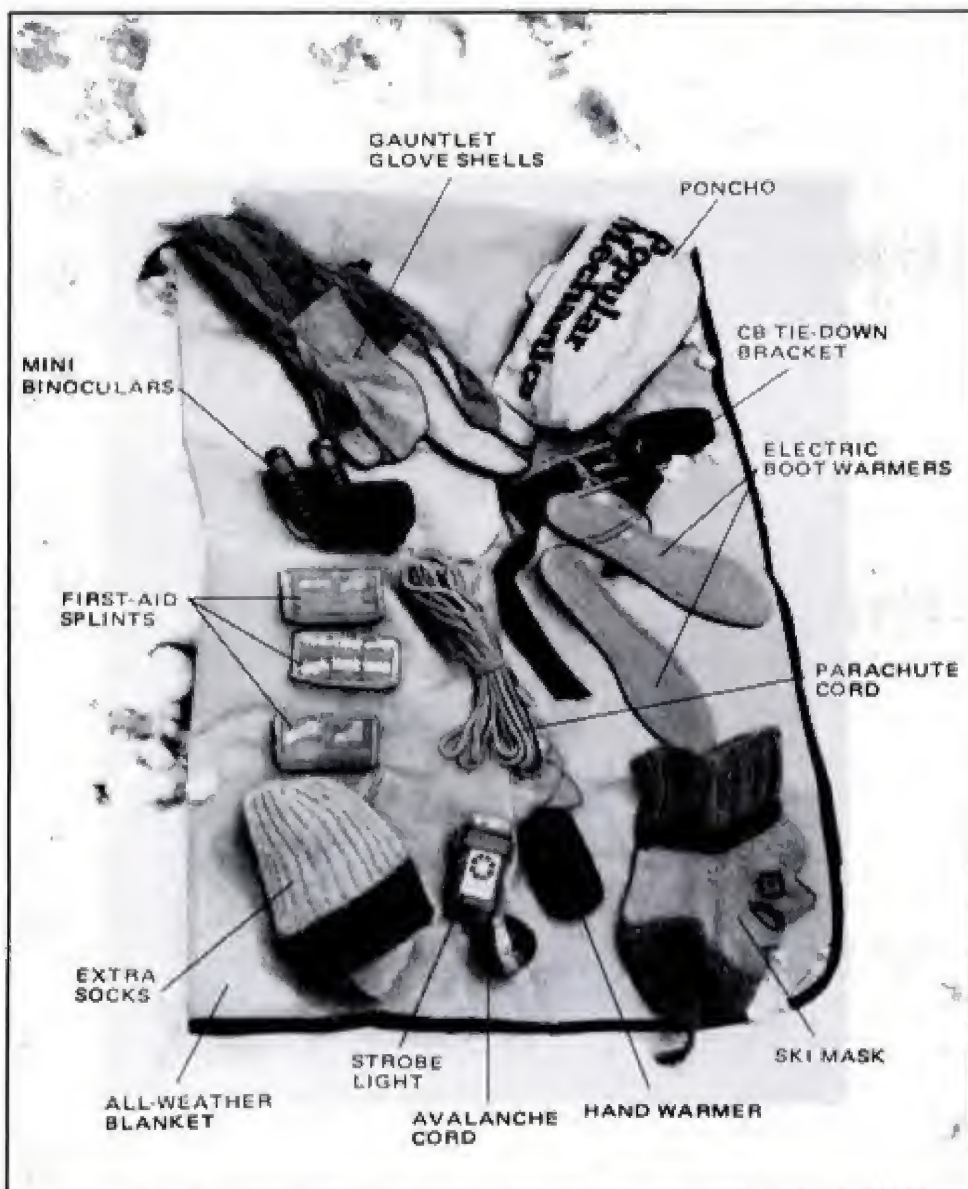
The ultimate in equipment for snowgoers could include: **A.** A rifle (the hibernating bear you disturb may be bigger than you are). **B.** CB radio and motorcycle tank bag with plastic top to protect topo map. **C.** Helmet, goggles, electric gloves, rear-view wrist mirror and snowmobile suit. **D.** Clamp-on boom mike for CB and intercom. **E.** Pleasant companion. **F.** Backpack. **G.** Thermal ice chest. **H.** Mountain tent. **I.** Snowmobile sled. **J.** Sleeping bags in stuff sack. **K.** Duffel bag holding the equipment shown on facing page. **L.** Bear-paw snowshoes. **M.** Snowmobile pac boots with removable felt liners. **N.** A dependable snowmobile—this one's a 1977 Moto-Ski Futura model from Bombardier. PM models are Dale Mell of Ski-Doo, Duluth, and Keri Thorne, Miss Minnesota for 1976.

PM photo: Pat Elder



It had been a sunny winter day of winding along forest trails and speeding across snow fields. But now total darkness had come and white flakes were dusting through the headlight beams as we headed down a frozen lake, trying to stretch our gas out toward the village six miles ahead somewhere in the night. Suddenly the headlight of one of our six machines dimmed and went out. Circling back, another machine coughed and sputtered from low fuel. With one snowmobile idling to provide light, we checked gas tanks, found one driver who hadn't been racing and had plenty of fuel, and sent her and her husband off to town to gas up and bring us a supply.

They were back in less than an hour, but that was plenty of time to joke about spending the night in the snow, wonder if our refueling team could spot our weak flashlights, and make mental checklists of what we should have had along. In the years



**Emergency gear** often means extra layers of dry clothes to conserve body heat and prevent wind chill when driving into strong cold gusts at speed.

Camping out in cold country, particularly when it can happen by accident, requires extra aids for keeping warm, rigging a shelter or windbreak, cooking, sleeping and signaling for help if necessary.

since then, we have added a lot of items and eliminated others. The result is a collection of basic equipment for day runs, emergencies that may last overnight, plus winter camping essentials. Many of these items would also make sense in the trunk of any snowbelt car or backpack of a cross-country skier.

What will the well-dressed snowmobile and driver wear this winter? We took our gear and lists out into the Rocky Mountain snows of the Grand Tetons above Jackson, Wyo., to test them with outdoors photographer Jim Elder and performance engineering teams from Bombardier's Ski-Doo and Moto-Ski snowmobile divisions.

### The essentials

First essentials, of course, are a small package of spare parts—extra sparkplugs and wrench, screwdriver, friction tape and the rest, plus a first-aid kit and waterproof matches. Extra sunglasses, a few plastic bags, and a Boy Scout or Swiss Army knife can be carried in a pocket or belt pack. A little reading ahead of time on first aid, frostbite, survival and mountain sickness doesn't fit in any kit but makes good sense.

Backpacks can be worn by both driver and passenger, though for a cross-country run, it is more comfortable if only the passenger wears one. A pack may be lashed on the



back of the machine and special customized snowmobile bags are also available. Rucksacks and belt pouches strap easily on rider or machine, and a motorcycle tank bag, made by Eclipse, has a transparent map case on the top, will mount in front of the driver for easy navigating, and can even be removed and worn as a backpack. Stuff sacks, duffel bags and that great Air Force surplus item, the parachute bag, can be packed aboard a tow sled, lashed down, and covered with a tarpaulin or ponchos secured in place most easily with elastic shock cords. A rigid tow-tongue for the sled is almost essential to keep it trail-tracking properly and prevent it from climbing aboard and up your back during downhill deceleration.

Up from the back of your machine can extend a fiberglass marker wand with orange flag, and slid under the securing straps on snowmo or sled can go small snowshoes, cross-country skis and possibly a rifle. A rifle? We remember talking with an old cargo wrangler who probably still spends late winters in northern Canada, heading up frozen rivers to supply fly-in camps. Once thaw comes, only airplanes can reach the distant lakes, but old Michel would head up with a diesel snow tractor towing a sledge train loaded down

## Checklist of equipment

### FOR COMFORT

■ Glove shells, Comfort electric gloves, poncho, ski mask, Frostline booties, Storm windshell parka, Stag Hand-warmer, Redfield mini binoculars, Comfort boot warmers, Reyco Frost-Guard cream, wool socks, wrist rear-view mirror, Thermos All-Weather blankets, backpacks, sled, Eclipse tank bag, duffel and stuff bags, Royal pac boots, Ski-Doo and Moto-Ski snowmobile clothing, sled.

### FOR CAMPING

■ Sleeping bags, tent, food, wire saw, Coleman ice chest, compass, canteen, matches, flashlight, candles, stove, cord, thermometer.

### FOR SAFETY

■ Signaling mirror, CB radio, snowshoes, first-aid kit, rifle, flares, strobe light, bandages and splints, avalanche cords.

### SOME EQUIPMENT SOURCES

■ Eddie Bauer, Third and Virginia Sts., Seattle, Wash. 98124.  
■ L. L. Bean, Freeport, Me. 04032.

■ Beltek (CB radio), 1093 Bedmar St., Carson, Calif. 90746.

■ Comfort Products, Box 9200, Aspen, Colo. 81611.

■ Company 3, Box 1859, Aspen, Colo. 81611.

■ Eastern Mountain Sports, 1041 Commonwealth Ave., Boston, Mass. 02215.

■ Eclipse, Box 372, Ann Arbor, Mich. 48107.

■ Frostline Kits, 452 Burbank, Broomfield, Colo. 80020.

■ Herter's, RFD 2, Mitchell, S.D. 57301.

■ Mountain Safety Research, 631 S. 96th St., Seattle, Wash. 98108.

■ Patzoldt Wilderness Equipment, Box 78, Lander, Wyo. 82520.

■ Recreational Equipment, Inc., 1525 11th Ave., Seattle, Wash. 98122.

■ Redfield Co., 5800 E. Jewell Ave., Denver, Colo. 80222.

■ Reyco Products, Box 1203, Sonoma, Calif. 95476.

■ Royal Red Ball Boots, Naugatuck, Conn. 06770.

■ Norm Thompson, 1805 N.W. Thurman, Portland, Ore. 97209.



**Stowing aboard** all the essential gear is easier with a rigid-tongue snowmobile tow sled where extra equipment can be lashed in place. Backpacks for both machine and riders, however, can also carry most items shown, secured with nylon and shock cord.

with supplies like food, gasoline, boats and outboard motors that would be heavy and expensive to ship in by air. Occasionally, during a blizzard, Michel and crew would find the river-bank remains of a trapper's abandoned cabin to hole up in. But there is no welcome as rude and unfriendly, he claimed, as that of a hibernating bear who'd found the cabin first. Michel carried a gun, with a scrap of masking tape over the muzzle to keep snow from packing into the barrel.

Snowmobiling is no pleasure sport unless you can keep warm while driving into a cold wind that increases the wind chill factor, and when stopped along the trail as well. Snowmobile suits can be supplemented with extra socks, ski facemask, extra gloves, handwarmers, poncho or water-resistant rain jacket for that day with miserable freezing rain, Thermos All-Weather thermal blankets that can also be rigged into a shelter, electric socks, gloves, mittens and boot warmers. Liquid and solid stick fuel handwarmers can also chase the chill from damp mittens and boots before you must put them on, and

*(Please turn to page 168)*



## Housebreaking frustrater

Smashing out a glass pane in the front or rear door, then reaching inside to unfasten locks and latches is a common method used by housebreakers to gain entry—unless you have a tricky lock or barrier to discourage them. A "vandal panel" of .22-inch Plexiglas now promises to deter such easy break-ins. The panel, 15 times stronger than regular glass, is mounted over the glass on the inside of exterior doors, basement and garage windows or other likely points of forced entry. Besides being impact-resistant, the tough plastic has a crystal clarity that makes it virtually invisible. Panels measure 30 by 40 inches and come with mounting screws, instructions. About \$30 at most building supply outlets. Rohm and Haas, Independence Mall West, Philadelphia, Pa. 19105.



## STOL transport swallows big ones

Existing tactical transport planes can't accommodate the sprawling dimensions of the Army's 26-ton, 155-mm self-propelled howitzer. But McDonnell Douglas's new YC-15 can. It also handles a 35-foot-long, 10-foot-high "Goer" truck, or a 31-ton, 8-inch howitzer. The plane was designed to haul big gear in or out of tight air strips.



## Tank train umbilical

Thanks to tricky hose links supported by swinging steel arms, a string of 10 railroad tank cars now can be loaded or unloaded from a single connection. The unique system, by GATA Corp., can handle 3000 gallons per minute.



## Wide-track bike kit

Want to convert your bike to a "trike"? There's a kit designed to fit most makes or sizes from 24-inch wheels up to light multispeeds. Front wheels provide more stability and cost under \$50. Tahran Mfg., Inc., Box 912, Jamestown, N.D. 58401. Dual forks support the wheels.



## Prop-driven skiing

When ordinary skiing got too tame for instructors and students in the Design Bureau of Russia's Mari Province Polytechnical Institute at Yoshkar-Ola, they put together a backpack engine with a two-foot shrouded propeller on the driveshaft. Then unit can, according to claims of the student engineers, shove a skier across flat country at speeds in excess of 30 mph. The speed is controlled by a hand-held throttle that is linked to the motor by means of a flexible cable arrangement.





# Dream stuff: PM's handsome platform beds

Take your pick of a king-sized platform with movable end tables or an economy, easy-to-build single sleeper.

by Mike McClintock  
HOME AND SHOP EDITOR

PM photos: Harry Hartman



The sweeping elegance of this luxurious platform is matched by its versatility. Full-length storage drawers slide out easily on casters and convenient end tables can be placed at any point along the 1-in. aluminum rails.



**H**idden beneath the elegant styling and generous proportions of PM's king-sized platform bed is more easy-access storage than you'll find in most closets. Although the bed looks luxurious, every decorative detail is built to serve a purpose. The platform overhang is designed to create a floating effect that makes a large piece of furniture seem less imposing. But the design also puts to use one of the biggest

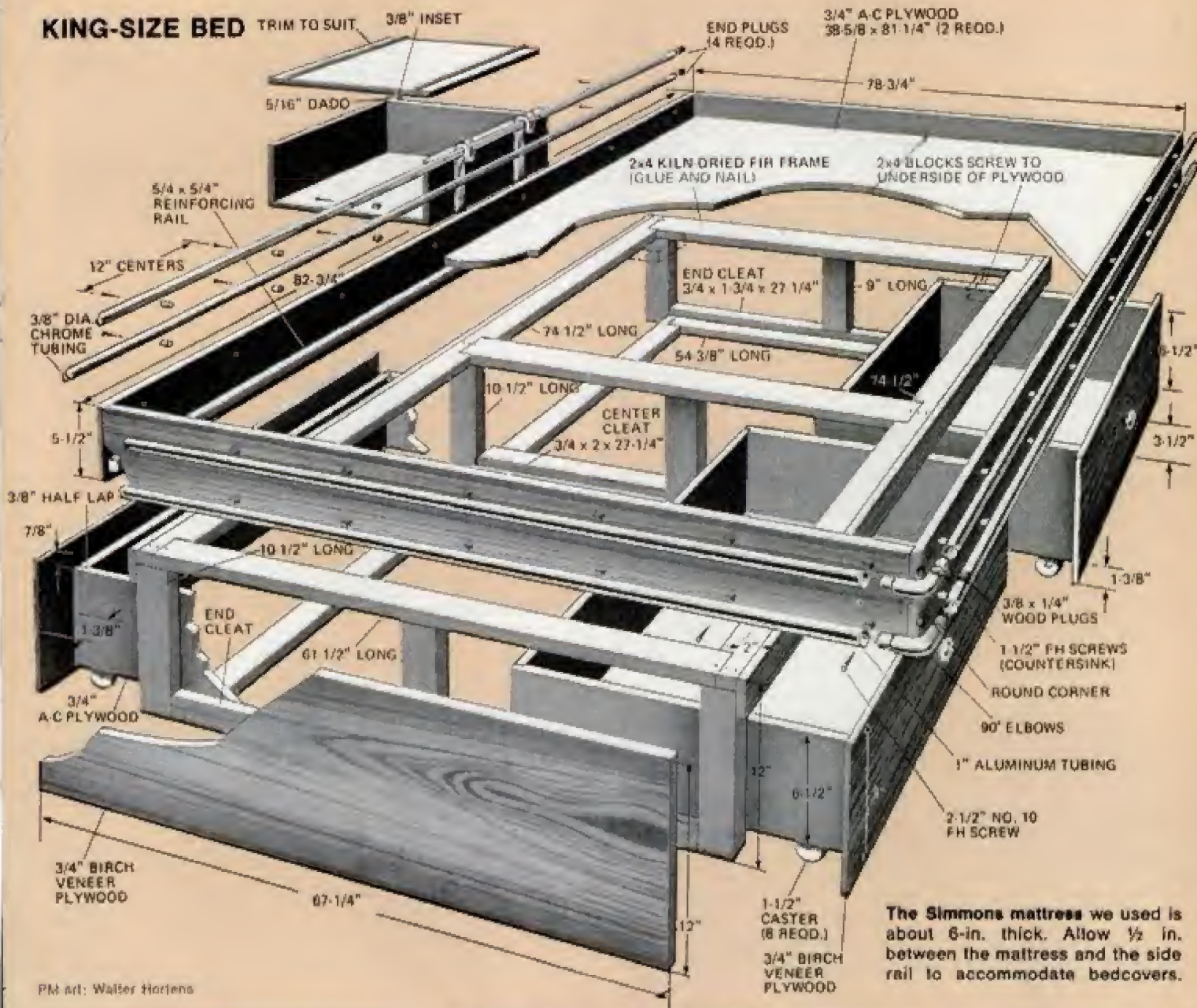
dust collectors of all time—the dead space under a conventional bed. The full-size drawers roll out easily on casters (even on a rug).

### Movable end tables

The rails are made from 1-in. aluminum tubing with compression-socket elbows connecting the straight lengths. The rails are attached with screws and spacers every 12 in. (see next page for details).

The end tables are designed in keeping with the free-floating look of the bed. Aluminum bar stock is bent like an upside down "J" to hook over the top rail and bear against the bottom one. The straps securely hold the end tables at right angles to the bed. But the design of the straps lets you move the tables to any point along the rails. Since the tables are supported without permanent hardware, you can move

## KING-SIZE BED



PM art: Walter Hortens

### HOW TO ORDER PLANS

As a further service to our readers, PM is offering a full set of working drawings of both platform beds, plus a six-page instruction booklet with how-to photographs and construction tips, for \$7.95. Send your order to Popular Mechanics Magazine, Home and Shop Dept., Box 1014, Radio City Station, New York, N.Y. 10019.



A plywood jig with nails supports the aluminum tubing for marking the screw holes.



Sliding storage drawers have casters on the front and Teflon glides at the rear.

The Simmons mattress we used is about 6-in. thick. Allow 1/2 in. between the mattress and the side rail to accommodate bedcovers.



them aside for better access to the drawers or to the end of the bed to support a TV set.

### Construction tips

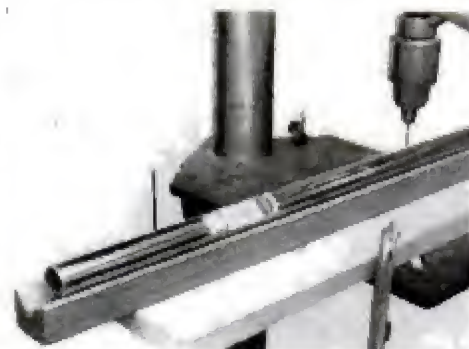
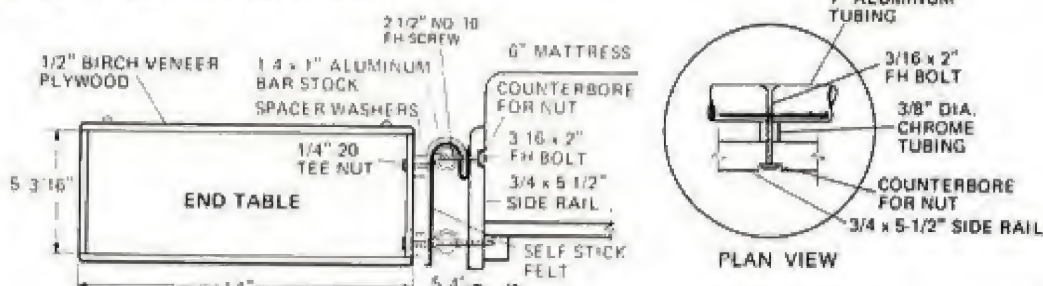
Use kiln-dried 2x4s for the bed frame. This dimensionally stable wood won't shrink and tighten up the drawers. To keep them operating smoothly, install Teflon guides at the back corners to reduce friction against the support cleats. Much of the construction won't be seen so you should devote the most attention to critical areas like the side rail corners. If you cut carefully, a simple butt joint is all that's needed.

You should clamp the joint in place and then counterbore for the screws and plugs. Then drill pilot holes through the joint so the screws will seat firmly without splitting the  $\frac{3}{4}$ -in. end grain. Take the joint apart to apply glue, then tighten up the screws in the predrilled holes. If you cut plugs (the same size as your counterbore) from your railing material, they'll be unnoticeable when you sand them flush.

### The single sleeper

PM's small platform is a less challenging project you can build in an afternoon. The simple base is made from plywood panels that are reinforced at the corners. Carriage bolts and wingnuts hold the pieces together and make the bed a good-looking piece of knockdown furniture. Either design will shape up a bedroom and put some style into going to sleep. ★★★

## END TABLE DETAILS



A grooved 2x2 will support the 1-in. Reynolds aluminum tubing during drilling.



A block with a 1 1/2-in. hole and a simple pipe tee guide the rail bending.



With this jig, the aluminum bar stock can be bent by stages in the vise.

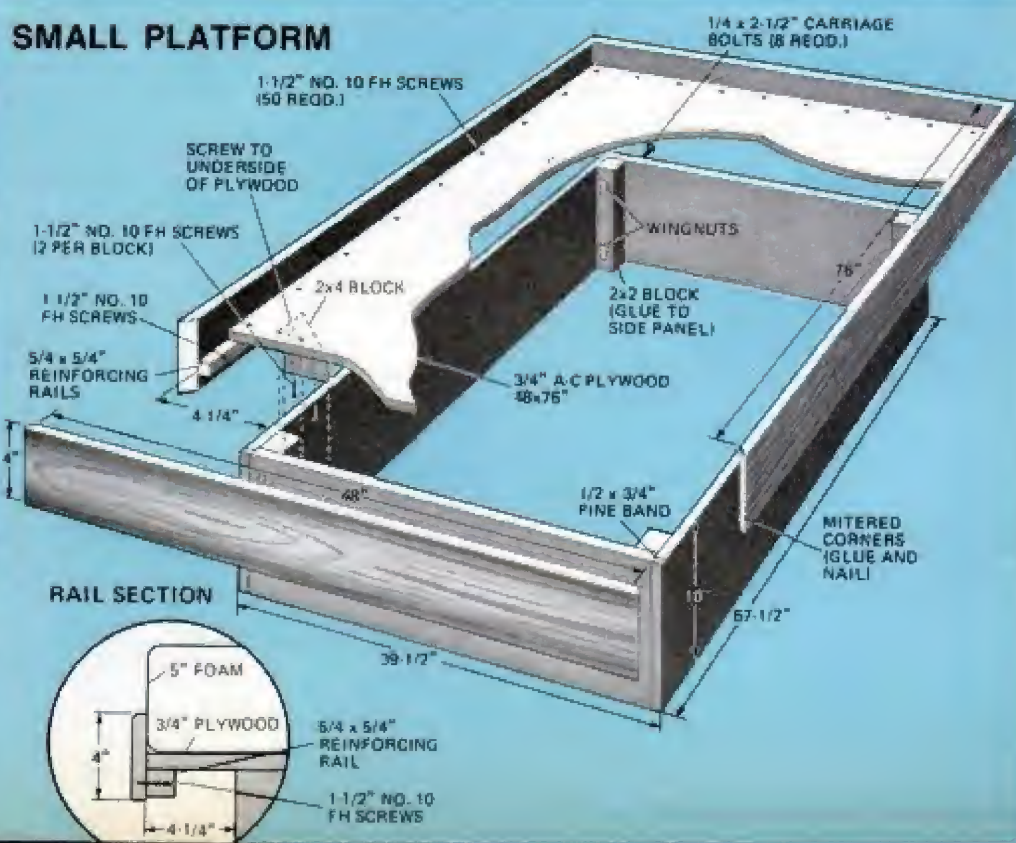


Self-stick felt lines the inside of the bar stock where it rests against the rails.



You can build this simple platform bed for about \$50, including the foam mattress. The solid platform is surrounded by pine rails, mitered at the corners and reinforced with 5/4-square kiln-dried strips. The support platform is made of plywood and painted to suit. Pull out the eight carriage bolts and the bed will store flat.

## SMALL PLATFORM





# IT'S NEW NOW



## 'Golfball' in the sky predicts earthquakes

Earthquake forecasts from outer space is a mission of the NASA-Geological Survey "Lageos" (Laser Geodynamic Satellite), recently tested at Goddard Spaceflight Center in Greenbelt, Md. Ground-generated laser beams aimed at the sphere will be reflected from "corner-cube" mirrors located in the satellite's surface ports. Like a corner shot on a pool table, the beam will be bounced back to receivers at the source. By clocking travel times of the laser beams, scientists can spot any changes in the movement of the Earth's crust between stations, thus measuring the displacement of tectonic plates—the cause of quake-producing stresses.



## Seagoing ambulance

*Star of Life I*, a new concept in medical service afloat, recently went on duty on Long Island Sound. Staffed by volunteer doctors, nurses and technicians, the 31-foot Uniflite fiberglass cruiser (basically a Navy PBR hull) carries \$12,000 in medical equipment. Twin 225-hp Chrysler Marine engines ram her through the chop at 35 mph. Operated by marine and local police and U.S. Coast Guard Auxiliaries in Stamford, Conn., she logged 800 hours of duty by mid-summer. She answered a dozen emergencies, including a cracked skull from a swinging boom. The victim, sped to a hospital, was saved. Fewer area accidents, officials think, are due just to the presence of the floating ambulance. Communities are invited to contact Fairfield Medical Products, 2777 Summer St., Stamford, Conn.

## Paint the wood, not the glass

Amateur window painters won't smear the glass so easily with this brush-and-guard device. A clip-on metal shield attaches to a handle that takes interchangeable brush heads of different widths depending on the job. Shield is spring-loaded to help it press against the glass. \$3.95, Meryl Lee & Co., 31974 Lasher Rd., Birmingham, Mich. 48010.



## On-camera mike for sound movies

Two new super-8 movie cameras, one with fixed focus, the other with a 9- to 21-mm zoom lens in Kodak's Ektasound series, feature microphones on the camera handle. They provide maximum mobility for the picture-taker, eliminating dangling wires—a big advantage at outdoor events. Extension mike goes with it for use when needed. The fixed lens 230 is priced at \$275 while the zoom 240 is available for \$400 at most photo supply shops.



## Digital clock-thermometer kit

This electronic alarm clock includes an indoor/outdoor electronic thermometer in a sloping-front package. Digital readouts are bright orange. Time reads to seconds, and the two temperature readings alternate. Besides a regular alarm, the clock features a "snooze" alarm for catnaps of 10 minutes to an hour. Instant touch-bar resets the morning alarm. There is even an alarm on the thermometer that sounds off when readings run above or below a preset temperature. Kit is \$125. Heath Co., Benton Harbor, Mich. 49022.





# Record care: Tenderness vs. tenderizing

by Ivan Berger ELECTRONICS EDITOR

**D**on't blame your records if they're full of noise, warps and scratches—blame yourself. Long record life is up to you.

It doesn't cost a penny to store your records properly (on edge, packed firmly together but not tightly squeezed), or to be sure you put them back in their dust jackets as soon as you've played them. And take care never to touch the recorded grooves—your fingertip oils will glue down airborne dust.

A dust cover for your turntable will keep records from getting dirtier while you play them and will slow down the rate at which the turntable collects dust it can transfer to the records later.


What's left is getting the records clean to start with. Shown here are a variety of tools for record cleanliness; devices that clean records as you play them, tracking along the grooves just as the tone arm does (right); gadgets to clean the discs just before you play them; devices to get dust off your stylus and to remove static electricity that attracts falling dust; plus a new lubricant.

My personal favorites here are the Zero-stat, the Discwasher, the Decca Record Cleaner, the Manual Parastat and Sound Guard, not necessarily in that order.

Polishing cloths don't clean down in the grooves where the dirt matters; and I suspect them of leaving dust-catching residues on the record surface. Record sprays are even more likely to catch dust.

One possible exception to this is Sound Guard, a new, dry lubricant which does actually seem to reduce record wear in lab tests — as shown under the microscope.

Most of the cleaners shown at the top of the next page are used damp—but *not* wet—the better to pick up dust without building up static. Europeans, though, swear by devices like the Lencoclean, which soaks the grooves as the record plays; but some experts feel this makes the record noisier if you play it dry thereafter; so if you start wet, stay that way.



Track your records clean with (from top): Audio-Technica AT-6002, \$10; original Watts Dust Bug, \$7; conductive Decca Record Cleaner, \$15; controversial Lencoclean which keeps grooves wet, \$13.





PM photos: Myron Dorf



Record cleaners vary in design: 1. Schweizer Designs Hydro Cleaner (\$10) has a built-in fluid atomizer. 2. Decca Record Brush has conductive bristles to avoid static, also stand with built-in

bristle cleaner (\$15). 3. Watts Parastat (\$15) has bristles in the center to loosen dust and plush ends to pick up dust. 4. Discwasher (\$15) has one-way slanted bristles and

pocket to hold solution bottle. 5. Watts Preener (\$4) is moistened by an internal wick. 6. Ball Brothers Sound Guard cleans and spreads a dry lubricant on the record (see photomicrograph below).



To clean dirty styli, try: Schweizer Designs AT-210 (rear, \$3); Audio-Technica AT-607 (center, \$3); Watts Stylus Cleaner (right rear, \$1.25); Discwasher cleaner with Inspection mirror (\$6).



Under the microscope, you can see thin shavings worn by even a fresh stylus (above, left), accounting for some of the fuzz that gathers on the stylus. But lubricated with Sound Guard (above, right), record appears fuzz-free. Grooves average 0.003 in. wide.



**Static attracts** dust back to records. To kill it, try Staticmaster 500 brush with 1-year Polonium ionization strip (\$15, replacement strips \$10), or piezoelectric Zerostat gun (\$30), which generates ions as you squeeze, release its trigger.



# Can electronics make you almost as smart as a fish?

The new gear can't yet set a hook, but it can tell you where to look.

by Mark Sosin



Today's complete angler may cram his cockpit console with a foghorn-hailer, RDF, CB scanner, radar, digital and graph depth finders.



Underway, gear aboard Boston Whaler Outrage points owner Pete Litinas, Teaneck, N.J., out toward big ones.

**I**t's true. There's no need for space age gadgetry when you want to catch a fish. But most anglers today like results as well as the relaxing aspects of the sport when you just sit, stare at the water and hope a fish will come along. Beginning fishermen and veterans alike are now installing a great variety of equipment and the advantage in finding fish seems to go to the boat with the best in electronic gear.

Perhaps the most valuable item is a depth sounder. It should be the first aid to consider when outfitting a fishing boat. The basic units designed for sport use, for about \$50 up to \$500, employ flashers that display returning echoes as a group of bright orange flashes on a circular

dial. With considerable practice, you learn to distinguish types of bottoms and spot pulses that indicate fish. Reading depth is simply a matter of matching the pulses to the foot or fathom markings around the dial scale. Some models with selector switches for shallow and deep measurements sound alarms to warn of shoaling water or fish passing below.

More effective are recording depth sounders which use graph paper and a stylus to trace the configuration of the bottom and anything in between. They provide an angler with a record of everything under the boat, and there is no need to watch it every moment for the signal of a fish, as you would with a rotary flasher. Recording depth sounders come in

straight-line and curved-line graph models, depending on the tracing by the stylus. Straight-line machines generally have better resolution, are somewhat more accurate, and cost more than curved-line models. A "white line" is a new approach that incorporates a second trace of the bottom, allowing you to more clearly distinguish fish that are lost on other machines.

Scanning sonar is the latest innovation. Based on sonar used to detect submarines, the sportfishing models have a transducer that rotates 360° and will indicate the depth, direction and distance of the fish from your boat. (Flashers and recording depth sounders operate with a fixed transducer that sounds down a cone under



the boat.) At the moment, scanning sonar is being marketed by Wesmar (Western Marine Electronics, 905 Dexter Ave. North, Seattle, Wash. 98109), and Aquascan (Stembridge Products, Box 90756, East Point, Ga. 30344). Wesmar had been making commercial models for 10 years prior to introducing their new unit for anglers. Both units are about \$1200.

Last year the state of Minnesota attempted to ban recording depth sounders on the grounds that they reduced the population of fish because they made things too easy for fishermen. The legislation was beaten. It should be remembered that depth sounders do not force a fisherman to catch more than the legal limit; are not a guarantee that he will catch any fish, and are solely an aid in locating them.

### New digital finders

Many boats are also being equipped with the recently developed digital readout unit that flashes water depth in numbers continuously while you run at any speed. These readout finders are often installed in addition to a recording machine. While the recording machine is painting a picture, the digital unit is giving immediate depth information. Among other depth finder innovations are two from Vexilar of Minneapolis, Minn. Its color-coded flasher gives a straight-line readout showing bottom depths in red and fish echoes in green, plus a stop-action button that freezes the display so a fisherman can study it. Newest from Vexilar is its CTR cathode-ray tube recorder that shows a continuous TV-type picture similar to that of the recording graph sounder, and the image can also be held in place for study.

### Temperature sensors

Temperature sensors are another valuable aid in both fresh water and salt. Most species of fish have definite preferences and tolerances of water temperature and it's important to know what the surface water is and where the layer of water is located which your choice of fish will favor. A well-equipped fishing rig may have a hand temperature meter that can be lowered to find optimum temperature strata, plus a built-in sensor that reads surface temperature.

Oxygen probes and light intensity meters are often coupled with temperature gauges and provide still more valuable information. Fish cannot live without ample oxygen, and an angler could be wasting his time in a lake or pond if there is not enough oxygen to support the fish that he seeks. The oxygen probe

(Please turn to page 196)



Portable depth finder and fish spotter is usually fisherman's first choice. Heathkit \$100 Dual Range has adjustable alarm.



Recording depth sounder charts bottom structure, fish, Heath \$290 White Line kit gives straight-line graph to 600 feet.



Both graph and flasher come with Ray Jefferson Dual Range Model 5300 at \$310. Features work together or separately.

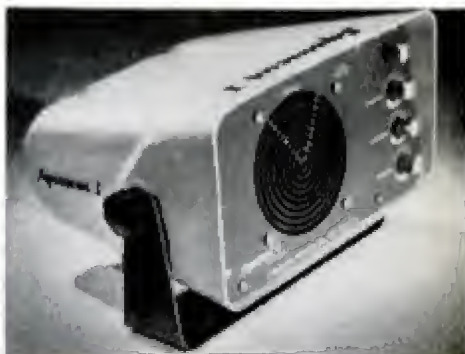


Temperature that a fish prefers can be located by lowering a probe. This \$28 Thermo Spotter kit from Heath has a 100-foot calibrated cable and battery-powered sensor.

Underwater radar is the effect given by Wesmar SS80 Scanning Sonar. Rotating transducer, diagrammed below, can be set to show bottom or sides of channel plus fish distance and direction from boat.



Range and location of fish are shown in a similar manner on the cathode-ray tube of the Aquascan I Scanning Sonar made by Stembridge Products. Unit is about \$1200.



Loran C is an expensive fishing aid, but can give skipper instant pin-point position by measuring radio waves from two stations. Decca DL91 is \$4995.





# All the fine points of a thorough distributor tune-up

All the work that goes into a first-class tune-up can be wasted if you don't look deep into your distributor.

by Mort Schultz

**E**lectronic ignition is coming on strong, but there are still 10 times more cars on the road with conventional distributors.

There's a lot more to distributor care than just adjusting point gap, and we'll cover all the maintenance on conventional distributors (Fig. 1) step by step. Servicing can be done with the distributor remaining in the engine, but it should be removed for bench work if a serious problem is revealed.

**1. Remove cables** from the distributor towers. Grasp the cable's boot, twist and pull. Do not pull on the cable itself.

As you take each cable from its respective tower, mark the cable and tower with some identifying number or letter. Each cable has to be returned to its respective tower to prevent damage to the engine.

Use clip-type clothespins or pieces of masking tape on which you've written an identifying number to mark cables. To identify towers, apply a piece of masking tape to each.

Remember: The tower and its respective cable must have the same identifying mark.

**2. Remove the distributor cap.** For the most part, caps are held by either a pair of clips or holding devices having slotted screw-type heads.

If clips are used, insert the tip of a screwdriver behind each clip, snapping the clip off the cap (Fig. 2).

If slotted heads are used, insert a screwdriver into the slot. Turn to disengage the latch.

**3. Examine the outside** and inside of the cap closely. On the outside look for visible cracks, broken towers and carbon tracks. A carbon track is a trail of soot running along the cap. It signifies a hairline crack.

On the inside look for burned or badly corroded terminals, worn center contact and carbon tracks (Fig. 3).

**4. Replace the cap** if there is reason to suspect damage. Make sure

when buying a new cap that it's the one for your car.

If you replace the cap, lay new and old caps side by side so markings and distinctive features are aligned. Transfer pieces of masking tape with identifying numbers from the towers of the old cap to the respective towers of the new cap.

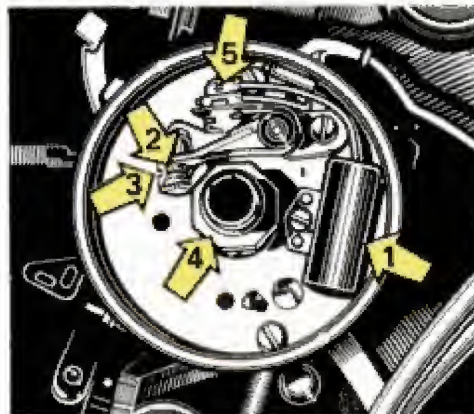
**5. If the old cap can be reused,** wipe it clean with paper towels or a clean rag. Polish terminals which are coated with a thin layer of carbon or are slightly corroded by

rubbing lightly with a piece of sandpaper.

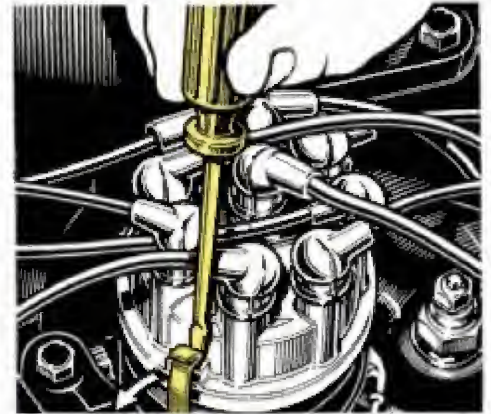
Clean out each tower. You can use a professional-type distributor tower cleaning tool, which can be purchased in an auto supply store, or a small, round wire brush.

**6. Take the rotor** from the top of the distributor shaft. For the most part, there are two kinds. One type can simply be pulled off (Fig. 4). The other, which resembles a cap that seems to cover the entire distributor, is held by two screws and

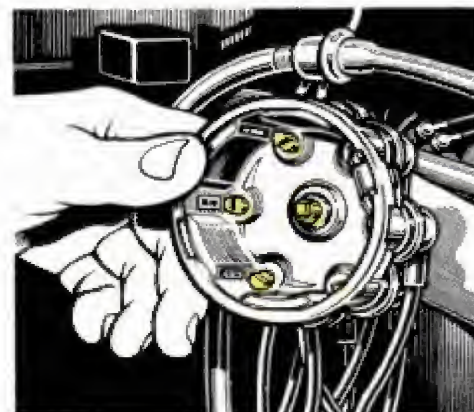
PM; art: Peter Trojan



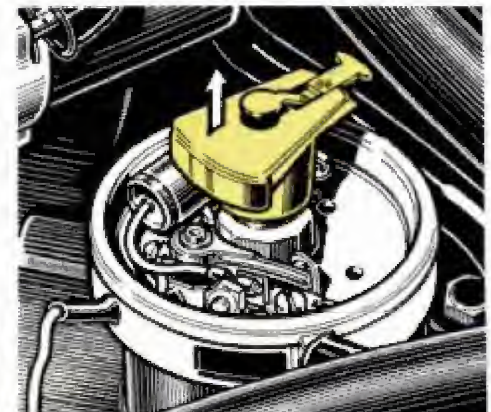
**1** Distributor: 1. condenser; 2. points; 3. gap-adjust notch; 4. cam; 5. condenser pigtail, primary wire terminals.



**2** Clip-type fasteners for distributor cap are snapped open to remove cap for access to components.

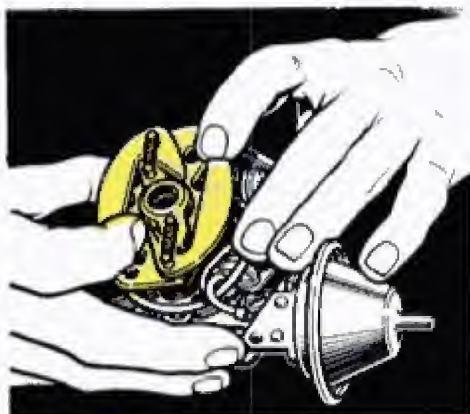


**3** Terminals for sparkplug cables and center contact must be inspected. They must be clean and not worn.

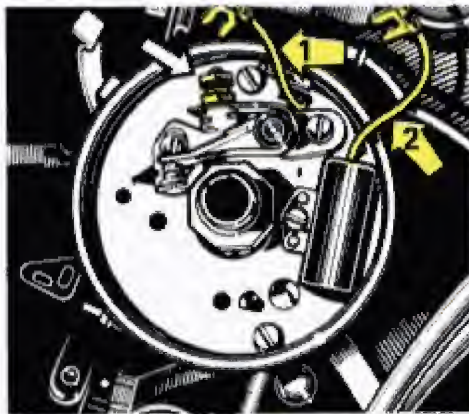


**4** Distributor rotor is removed from shaft and inspected. Make sure it is not cracked or worn excessively.

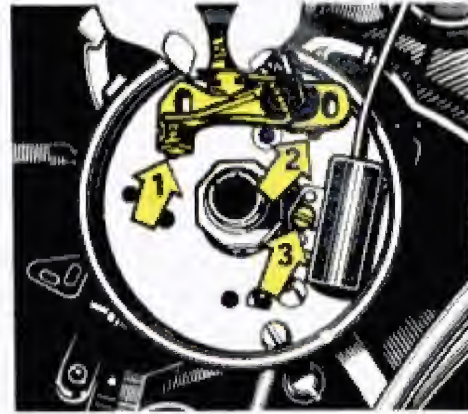




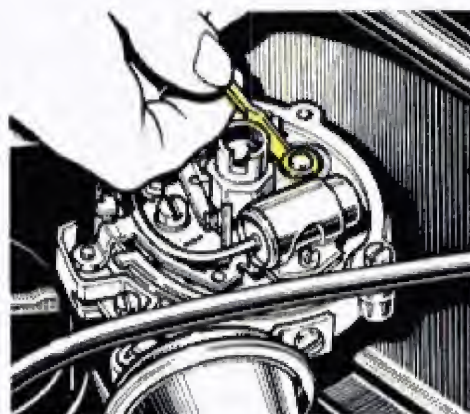
**5** Centrifugal advance mechanism is positioned just underneath distributor breaker plate on the shaft.



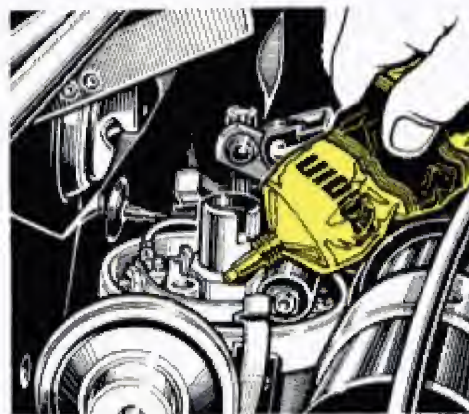
**6** Check wires: primary lead (1) and condenser pigtail (2). Arrow points to connector for the two wires.



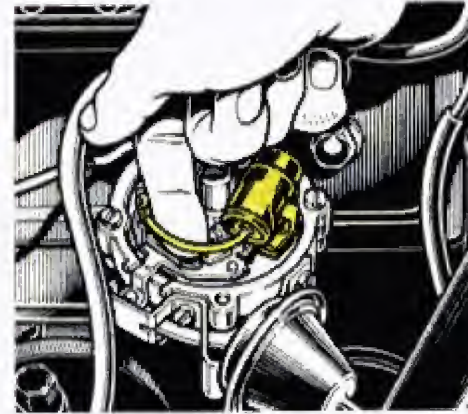
**7** Remove distributor point assembly held at mountings (1) and (2). Note condenser mounting screw (3).



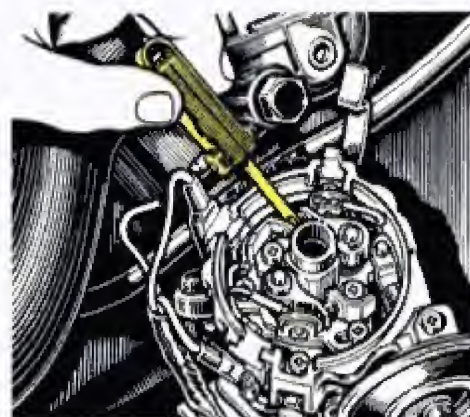
**8** To replace cam lubricating wick in the distributor, release small, lock-type washer with a screwdriver.



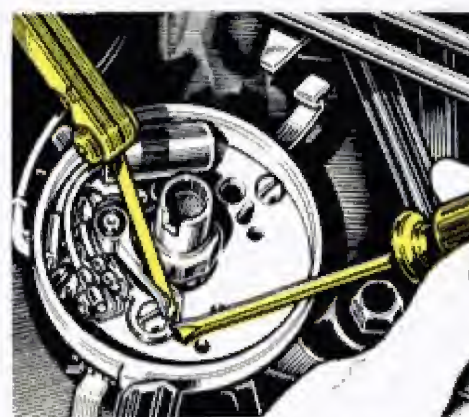
**9** Distributor cam must not be over-lubricated. With cam lubricating wick, do not lube cam at all.



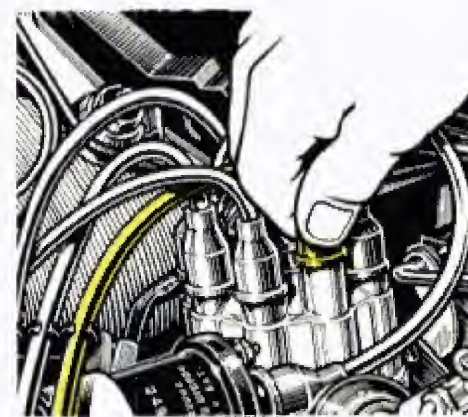
**10** Condenser pigtail and primary wires should be routed so that they won't contact moving parts.



**11** Feeler gauge must be held properly to get accurate reading. This distributor uses two sets of points.



**12** Point gap can be set accurately by means of the adjustment notch in the point assembly.



**13** Squeeze boots as you replace wires. This releases trapped air and makes positive connection.

washers that have to be removed.

7. Examine the rotor as carefully as you did the distributor. Look for cracks, carbon tracks, breaks, and a burned, corroded or broken metal terminal. Replace a rotor showing even slight damage. Be sure you get the one for your distributor. Not all rotors are the same size although they may be of the same configuration.

8. You may see some sort of cover over the distributor. This is a radio frequency interference (RFI) shield

and has no bearing on distributor performance. The shield is in two halves. Remove screws and lift each half off.

9. Find out if the centrifugal advance mechanism is functioning properly. The centrifugal advance is the mechanism, consisting of counterweights and springs, that alters ignition timing by means of centrifugal force as engine speed varies.

The mechanism may be in full view, sitting on top of the distributor shaft. If it is, twist the two parts

of the assembly until they are wide apart (Fig. 5). Let them go.

If the parts spring back together, you can proceed to the next step. If not, then the reason for the trouble—whether weak springs, a damaged mechanism or binding distributor shaft or bearings—should be found.

In other distributors, the centrifugal advance is positioned beneath the breaker plate, and you can't get to it. To find out if it's working properly, place the rotor back on the

(Please turn to page 156)





# Samurai steel for your shop



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These Japanese tools are  
handmade and tempered with tradition  
from centuries of swordmaking.

by Mike McClintock HOME AND SHOP EDITOR

**Y**ou probably haven't seen these tools at your local hardware store. But if you enjoy carpentry, you'll be interested in how they do it in Japan. The design and use of these handmade tools stem from centuries of fine swordmaking. The spirit of Japanese construction, which combines simplicity, grace and utility, is readily apparent in these tools once you know the jobs they're designed to do. The azebiki saw (B), for example, is used to make mortise and center cuts where a short, stubby blade is ideal. If you've already noticed the slant of the teeth on the large gando saw (D), you've picked out the biggest difference between Japanese saws and ours. The teeth are set to cut on the pull stroke, a unique feature that takes some getting used to. In contrast to the long-handled saws, the planes have no handles at all. After some practice, you'll appreciate the sensation of the pulling cut at your fingertips. Woodcraft Supply Corp., 313 Montvale Ave., Woburn, Mass. 01801, is importing these reasonably priced tools (azebiki saw is \$7.60). ★★★

- A—Mawashi-Noko: A fine-toothed keyhole saw with a sharpened point.
- B—Azebiki-Noko: Double-edged saw for mortise and center-start cuts.
- C—Shakuri-Ganna: A shoulder rabbet plane made from hard, white oak.
- D—Gando-Noko: A heavy-duty saw for making rough cuts in timber.
- E—Ono: A lightweight, delicately balanced Japanese hatchet.
- F—Dozuki-Noko: With 24 teeth per inch, this backsaw makes fine cuts.
- G—Hira-Ganna: A 14-inch block plane with laminated steel cutter.
- H—Oire-Nomi: Chisels with hollow-ground blades for long-lived edges.
- I—Nankin-Ganna: Shape the handles on this spokeshave for your grip.



Japanese Nomi (chisels) have hollow-ground blades made of laminated steel. The blade tang extends 1½ inches into the handle. Striking end is wrapped with an iron ring to prevent splitting.

The picture isn't backward. The planes (and saws) are made to cut on the pulling stroke. The no-handle design gave me some problems, but you do get a good feel for strength and depth of cut.

plus photo: George Ratkai

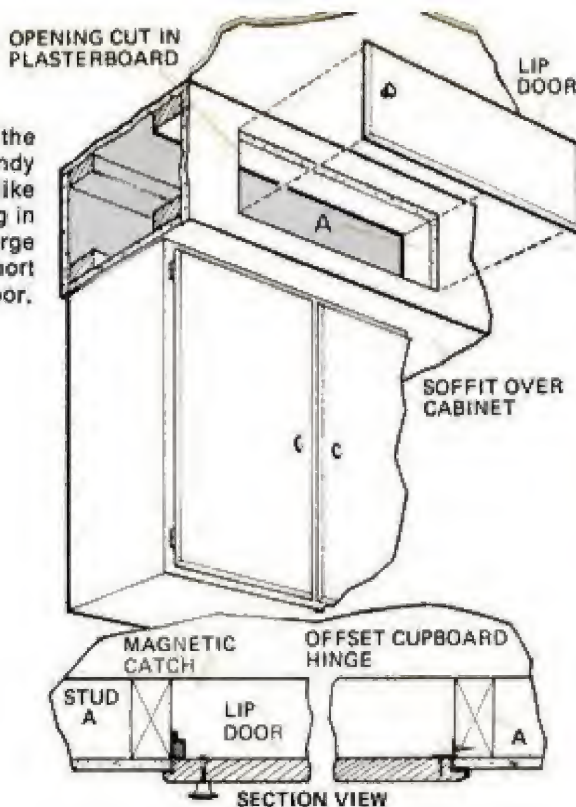


## 1. Unused soffit space

The dead space going to waste within the soffits over kitchen cabinets offers handy storage for items used only on occasion like Christmas dishes and glassware. Make the opening in the plasterboard as large as space permits, then install short studs at the sides to take a lip-type door.

If you're hurting for extra cupboard space and see no way of gaining more, chances are you have overlooked potential storage space that's actually there and going to waste. In some cases it's dead space within a kitchen wall and the soffits over cabinets; in others it's space under wall cabinets and on the surface of a door.

The four space adders shown here show how you can put this waste space to work by building in or adding on shallow cabinets to give extra storage for canned goods, spices and items you don't often use.



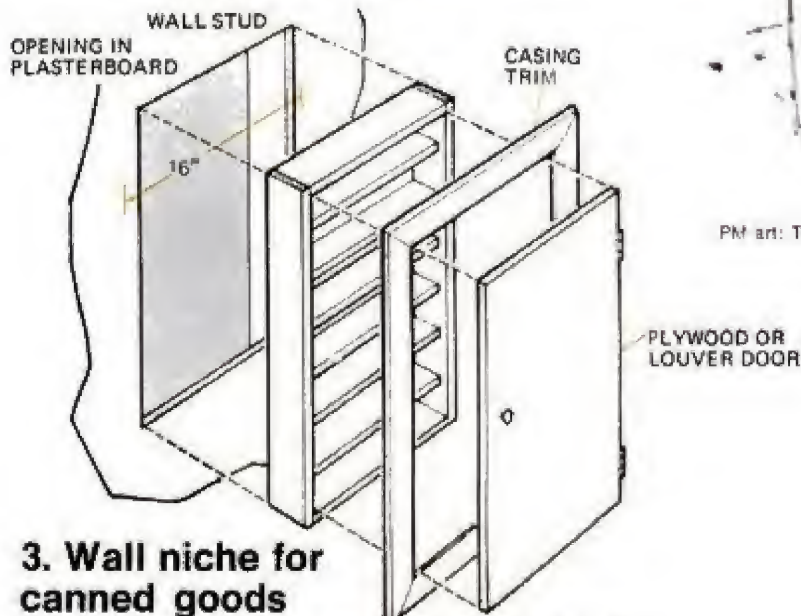
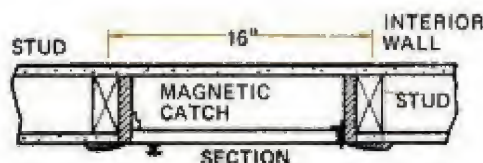
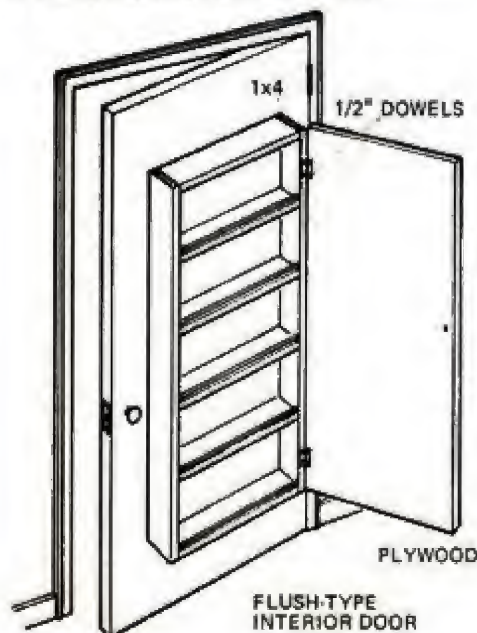
# 4 space adders for crowded kitchens

3

by Wayne C. Leckey  
SENIOR EDITOR

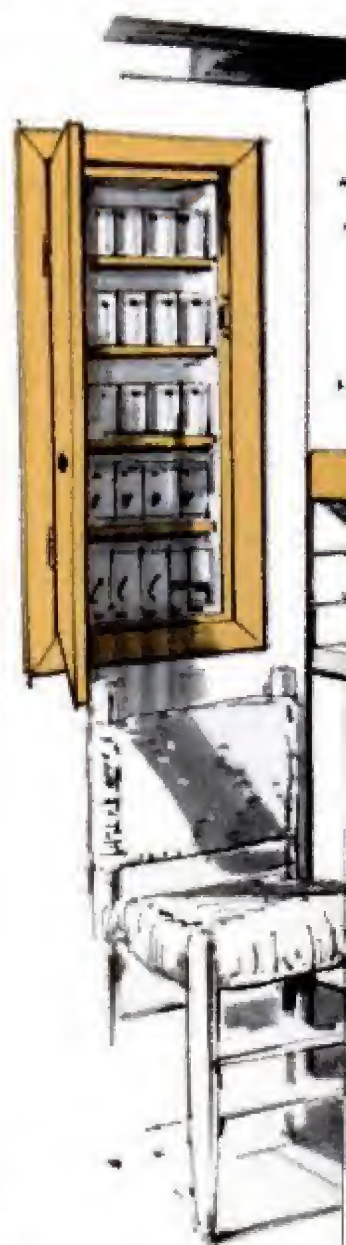
## 2. Piggyback door storage

Hang a shallow cabinet fitted with shelves and a door on the inner surface of a hollow flush door and you'll gain more storage space for can and package goods. Make the cabinet of 1x4s, add a dowel railing across each shelf and hang it with L-brackets and Molly bolts.



## 3. Wall niche for canned goods

Hollow space in an interior wall offers storage galore for canned goods. The 3½-in. width of the studs is ample to accept row upon row, one-can deep. The cabinet is made to fit between a pair of studs. The door can be fitted flush with the wall for soup-size (2¼-in.) cans, or it can be brought out an additional ¾ in. by a deeper frame to accept 3-in.-dia. cans. See that wall is free of pipes and wires. Locate studs by tapping the wall lightly with a hammer for solid sounds.



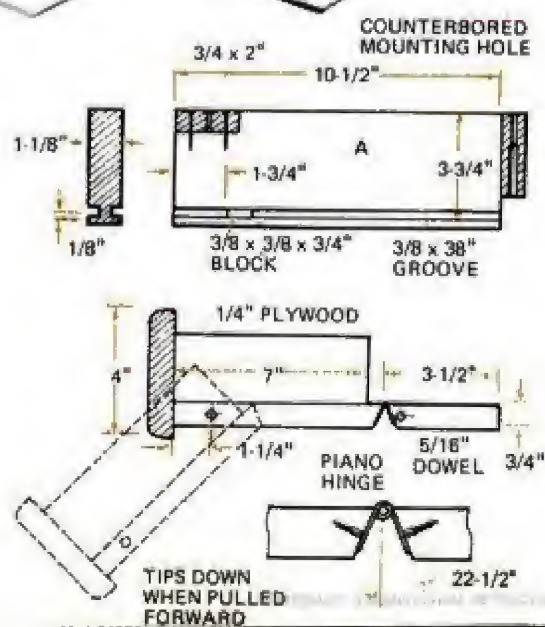
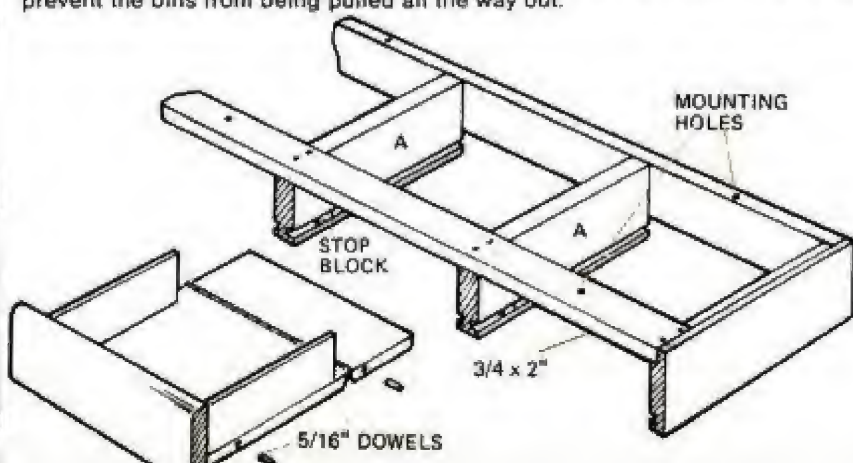


# 1



## 4. Under-cabinet storage

Without sacrificing counter space, extra storage space can be gained by hanging a row of 4-in. binlike drawers from the underside of your wall cabinets. They're handy for keeping spices, napkins and the like at your fingertips. Each hinged bin pulls out like a drawer and tips down at an angle for full access to its contents. The bins ride in a frame assembly attached to the cabinets with screws in counterbored holes. Stop blocks in the dowel-pin grooves prevent the bins from being pulled all the way out.





# Snow-melting systems you can install

These methods do away with the drudgery of snow removal by hand, prevent accidents and eliminate snow damage to your home.

by Penelope Angell

ASSISTANT HOME AND SHOP EDITOR

**H**ow many times have you grumbled to yourself about there "being a better way" as you headed outdoors, shovel in hand, to clean the walks? There is a better way. Snow-melting systems can be installed to keep ice and snow from accumulating on your roof and to clear your driveways and sidewalks.

Three types of snow-melting systems are available for home use: 1. Electric heating cable can be installed on your roof to eliminate snow dams on the overhang. 2. An electric heating cable system can be embedded in driveways and sidewalks. 3. A hydronic pipe system in which a heated mixture of antifreeze solution or hot oil circulates through

the pipes to melt the snow can also be embedded in the pavement.

## Electric roof cables

Heating cables can help prevent damage to the roof gutters and interior walls of your home. They melt the snow, eliminating heavy snow and ice accumulation on roof overhangs and stopping ice dams from forming in gutters and downspouts.

Ice and snow accumulations tend to develop particularly on homes with large roof overhangs that are not warmed by heat from the building interior. Snow dams are formed when sunshine and heat rising from the heated building partially melt ice and snow on the upper part of the

roof. The slush runs down to the cold gutter or unheated roof overhang, where it again turns to ice and continues to collect. Beneath this build-up, water rises under the shingle tabs, spills over the back shingle edges and can drain through the layers of stapled felt paper, down the rafters, and onto interior ceilings and walls.

The cable that prevents these ice dams is an insulated wire that heats to melt the snow when electrical current flows through it. Available in varying lengths from 5 to over 160 feet, it can cost from 50 cents per foot for the short lengths to 25 cents per foot for the long ones. The cable and kits that include clips for fastening it to the shingles are available at hardware stores and electrical supply houses. Each length of cable is equipped with a cold lead wire, several feet long. It plugs into a waterproof outlet box, usually located near the eave. The cable operates on normal house current of 120 volts and consumes electricity at a rate of 6 to 16 watts per foot.

You should install the cable in a zigzag pattern along the roof edge. In this pattern about 2½ feet of wire are needed per linear foot of roof. For installation in gutter and downspout a straight run of wire is used. Where eaves don't overhang the house, you may only need cable in the gutter and downspout to melt the snow. If heating cables are used on either roof overhang or gutter, the downspout must also be heated to carry away the water from the melted snow and ice. A heated length of wire is dropped inside the downspout to the bottom (even if it is un-

Photo: Easy Heat-Wirecraft



You can install heating cables on your roof with clips fastened under the shingles. About 2½ ft. of wire are needed per linear foot of roof. For installation in gutter or downspout, a straight run is sufficient.

PM art.  
Charles  
Bentz





derground), using weights if necessary. All gutters and downspouts should be grounded to a driven ground rod.

The best way to provide electric current to the cable is to locate waterproof outlets on the exterior walls of your home fed by a No. 12 gauge or other heavy wire. Cables can't be shortened or spliced. Each length must be plugged in separately.

To turn on the system easily, a switch should be located inside the house. A pilot light that shines when the system is on is recommended to remind you to turn off the system when it's not needed.

### Heating cables in pavement

Melting snow and ice on driveways and sidewalks is easily done by means of heating cables embedded in the cement or asphalt. These cables are available either already pre-spaced in mats, or in individual lengths which can be laid down at spaced intervals.

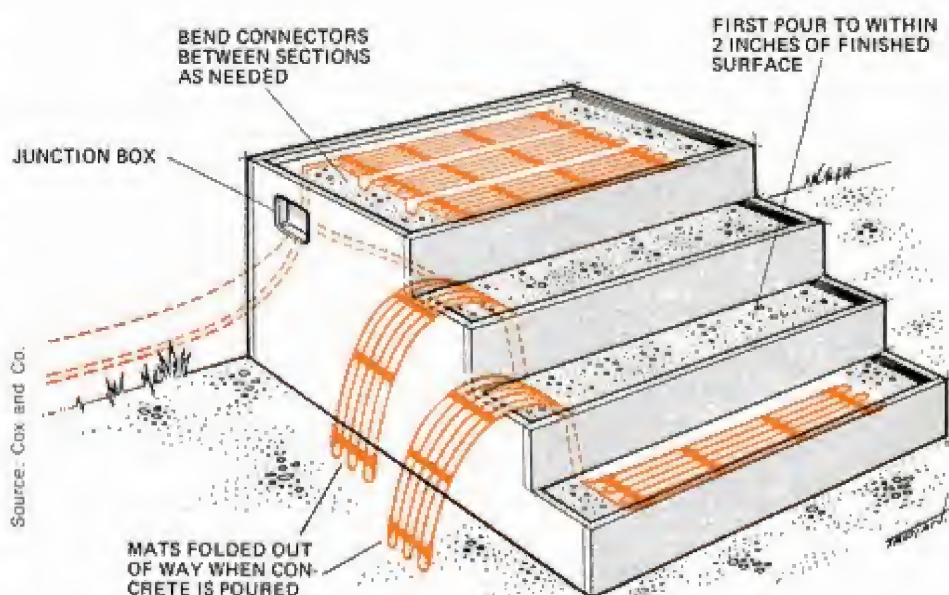
Mats can be cut to follow contours or to curve around objects. However, care must be taken that the heater wire is not damaged in the process.

Cables are covered with plastic insulation which permits them to be buried directly into concrete or asphalt. Cold lead wires are attached to the heating cable. These lead wires must be long enough to reach a dry location for terminating.

Snow-melting systems are designed for average conditions. This means that during heavy downfalls the snow will accumulate slightly. You can minimize installation and operation cost by using two 18-inch-wide heat strips for the wheel tracks of your car, rather than a system to melt snow off the entire driveway. A mat 18 inches by 4½ feet costs approximately \$30 without installation. Cost of two 18-inch-wide by 30-foot-long mats for a 30-foot driveway would be about \$165. Cost of individual cables would be less.

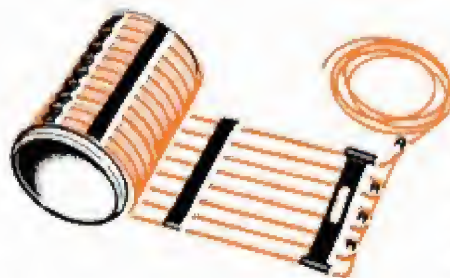
You can install heating mats and lay individual cable yourself. A licensed electrician can wire and connect the units to the household electric supply. A reputable supplier of heating equipment can usually give adequate advice on the capacity needed for your situation and the method of connection. Manufacturers can also give helpful information.

The spacing of individual heating cables depends on the watts-per-square-foot required, which varies with the average number of hours and inches of snowfall per year in each area. Cable is usually rated at 10 watts per square foot. There are many variables involved in the cost of operation. Yearly operating cost



Source: Cox and Co.

PM art: Smith-Gates



Mats of pre-spaced heating cable embedded in steel wire mesh can be installed without time-consuming task of spacing and fastening down each cable. The mats are available in sizes to fit a stair step, or in larger sizes for sidewalk or driveway from 1½ by 4½ ft. to 3 by 30 ft. Mats can be shaped to fit around curves or odd-shaped obstacles.

in Chicago, for example, for a 30-foot-long driveway with 18-inch-wide mats for car tires, using a system consuming 40 watts per square foot would be about \$26.

When you install the cable, a lead wire must terminate at a junction box. The junction boxes can be placed in the slab where the cable is laid, or brought out to a main supply point. If boxes are exposed to weather they must be of the outdoor waterproof type as specified by the National Electric Code.

Wires can be laid when new cement or asphalt drives are built. To wire an existing asphalt drive, a cable-asphalt sandwich can be built.

### Hot fluid melting systems

An alternative to the electric cable method of melting snow from driveways and sidewalks, particularly for large homes and commercial use, is the hydronic pipe snow-melting system. Pipes are embedded in the pavement through which heated antifreeze or oil circulates to melt snow.

The Hydronics Institute, 35 Russo Place, Berkeley Heights, N.J. 07922, publishes a booklet containing information and procedure on installing a home hydronic system called *Snow Melting Calculation and Installation Guide for Residences* (No. S-40).

A standard system uses ¾-inch pipe on 12-inch centers buried within concrete, or on 9-inch centers in asphalt. These pipes are in S-shaped coils that can be connected by means of a supply and return main to a heat exchanger which is attached to the house heating boiler or auxiliary boiler.

Components needed for the system include a gas or oil-fired boiler, heat exchanger, heater pump, expansion tank, gauges, valves and controls, the pipe that circulates the liquid and the liquid. A boiler needed to melt snow on a 500-square-foot area would take up less space than a washing machine in your basement. Flexible polyolefin and rigid copper tube or wrought-iron pipes are among those used in the system. A thermostat is also suggested for heat control.

Some manufacturers provide a package arrangement including design, engineering, materials, labor, on-site inspection and a guarantee for installing the system. This package is the most trouble-free but also the most expensive. A homeowner who is handy could purchase needed materials and do his own installation for much less. However, it would be wise to employ a specialist for welding work if rigid pipe is used.

★★★



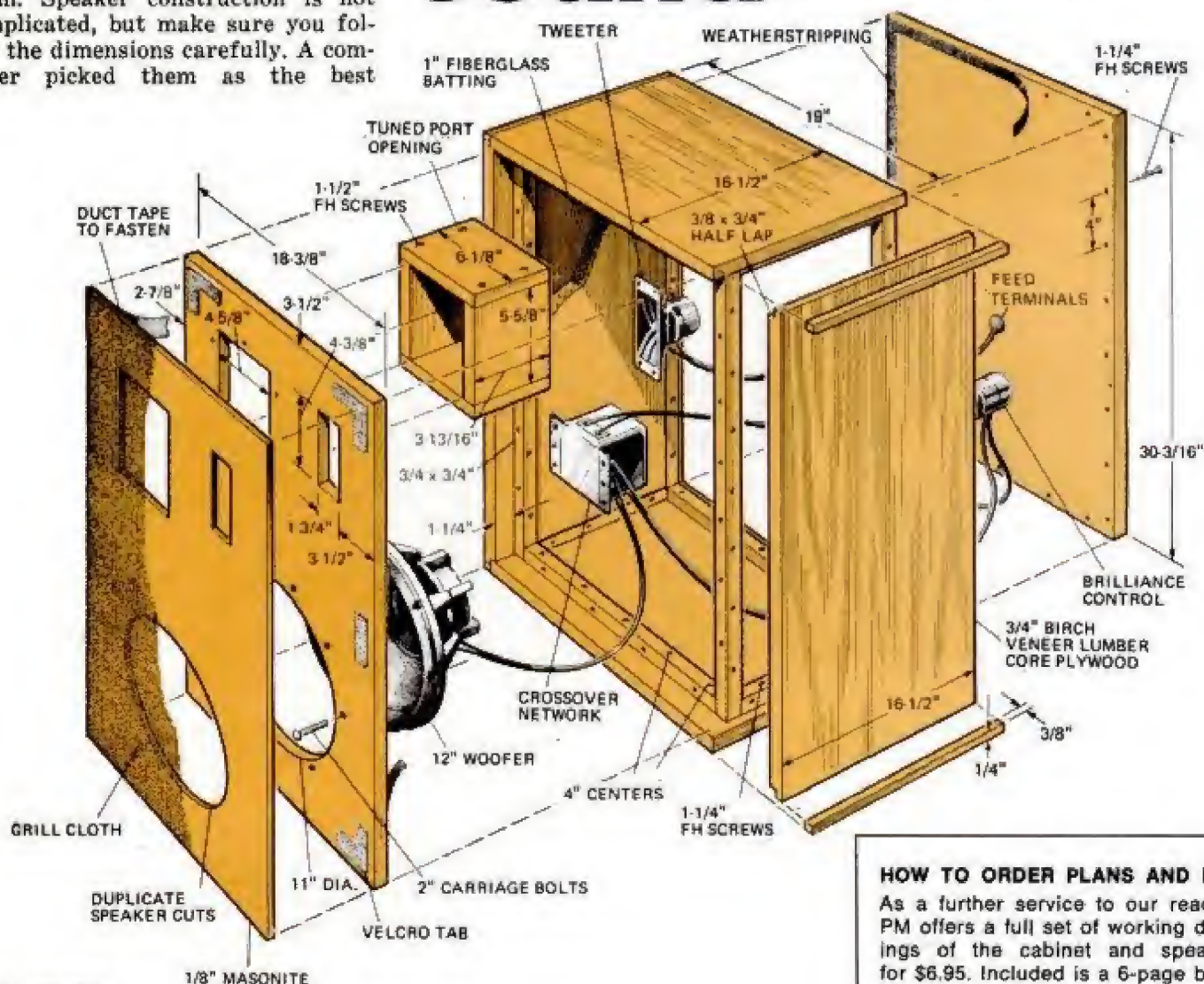
**W**hat turns you on to a stereo system? For most people it's a combination of good sound and good looks. The cost is generally the only hangup. The way to beat the high price tags is to build the cabinets yourself and sink your money into individual components. By following PM's plans you'll get a handsome and complete package for your equipment that includes matching speakers and a healthy amount of record and tape storage. It's not a rigid design. You can easily adapt the front panel sizes to the components you plan to get or have.

We made the cabinets from birch-veneer plywood and kept the design clean and simple so it would look good without overpowering the room. Speaker construction is not complicated, but make sure you follow the dimensions carefully. A computer picked them as the best

# How to build a great wall of sound

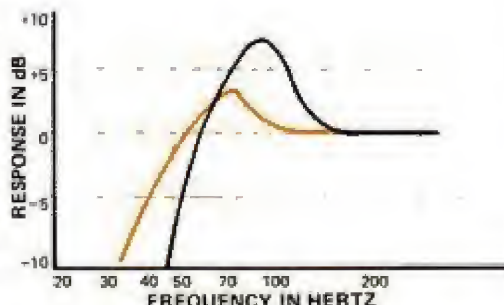
PM's stereo wall combines efficient storage, easy-access components and computer-designed speakers, tuned for the ultimate in sound.

by Mike McClintock  
HOME AND SHOP EDITOR



PM art: Fred Wolff

The computer's best effort produced PM's "A" curve. Even a small error in the dimensions of the port would change the smooth, deep bass of our curve into the falsely peaked bass of curve "B," a design the computer rejected. New Electro-Voice components make up this easy-to-build, two-way system that puts you front row center—at home.



## HOW TO ORDER PLANS AND KITS

As a further service to our readers, PM offers a full set of working drawings of the cabinet and speakers for \$6.95. Included is a 6-page booklet of instructions with how-to photographs. You can also order the Electro-Voice components from PM. Each set (with woofer, tweeter, crossover, wiring harness and controls) is \$157; \$314 for the stereo pair. Plans are shipped free with this order (add \$10 per speaker for shipping and handling). 3M's cassette holders are \$4.98 for 6 and \$24.90 for 30. Send your order to Popular Mechanics, Home and Shop Dept., Box 1014, Radio City Station, New York, N.Y. 10019.





Spring-loaded cassette holders, made by 3M, are built in above the components. The Marantz stereo receiver (Model 2235B) and Pioneer's top-of-the-line cassette deck (Model CT-F91B1) are both panel-mounted and feature easy-to-read, pushbutton controls. We picked a Dual changer (Model 1249) because of its dampened mounting and front-access cue control.



possible proportions from thousands of combinations.

### The speaker enclosures

Although a mitered corner joint might have looked best (since we cut the panels from the same sheet and matched the grain at the joints) we chose a half-lap with a solid birch band to cover the plywood end grain. This joint is easy to make, protects the veneered edges and can stand up to the powerful vibrations generated by the 12-in. woofer.

On the inside, glue and screw  $\frac{3}{4}$ -in. plywood strips to support all the

interior joints. Cut the front and back panels after assembling the frame. Here are tips to make your job look good and sound great.

■ Don't substitute ordinary fabric for grille cloth. Most audio stores have a good selection in different colors that's specially made with an open weave for speaker fronts.

■ You can substitute fiberglass insulation for acoustic batting—it's the same thing. Staple it to all interior surfaces except the front component mounting board.

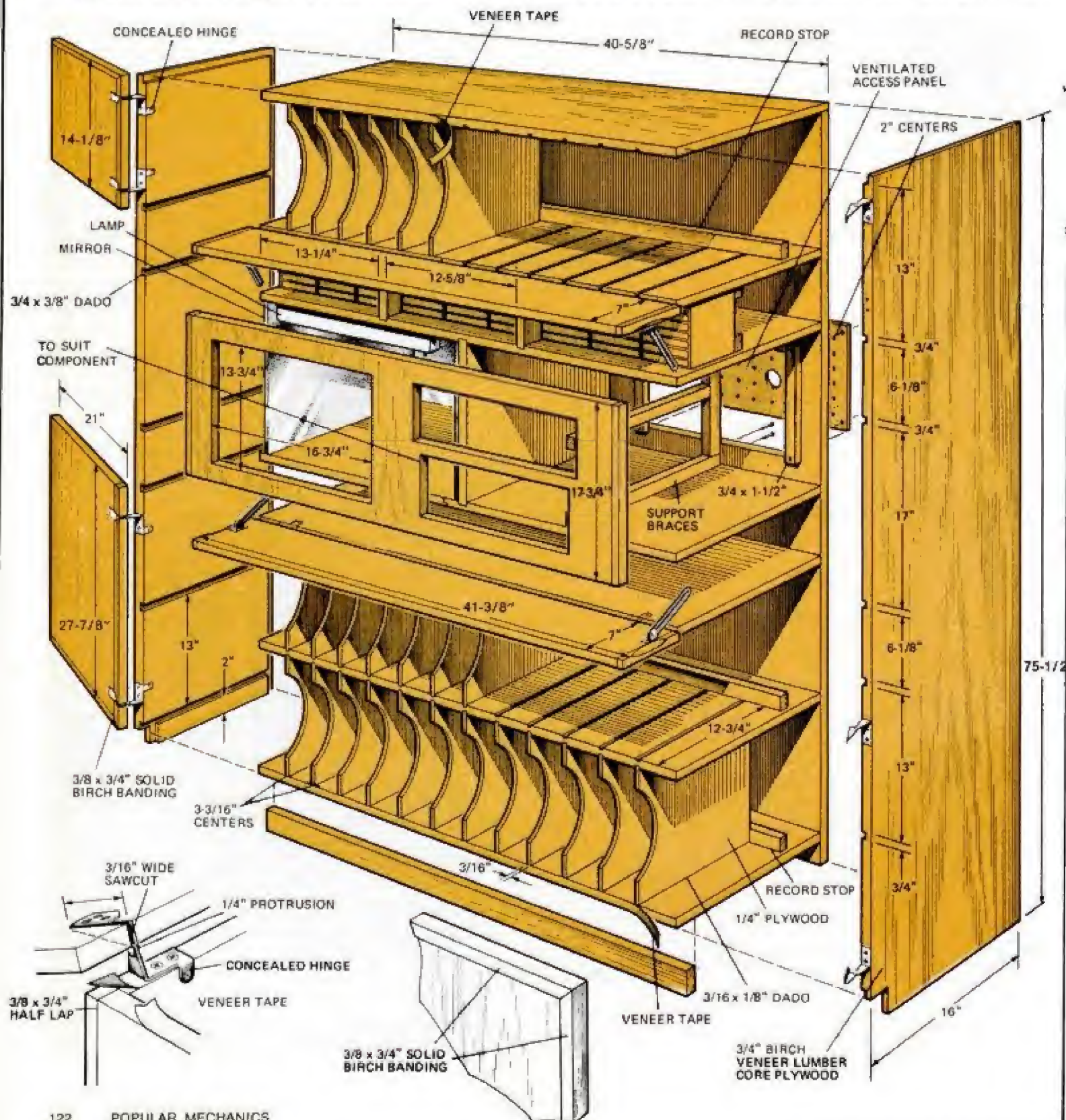
■ Exercise caution when sanding the veneer. Modern veneers are not even

skin deep and a powerful sander can eat through them. Patching to match the grain is almost impossible.

■ Invest in a carbide-tipped saw blade. Even the most accurate assembly won't look good if the edges of the veneer are split or chipped irregularly by saw cuts.

■ To keep the construction free from the effects of vibration, you must use glue and screws. A ratchet screwdriver (or Yankee drill) will save you a lot of time here.

■ The grille cloth is stretched over the  $\frac{1}{4}$ -in. hardboard panel and a 2-in. flap secured to the back with duct







**Square layout** is essential for good looks on the cabinet and for tight, vibration-proof construction of the speakers.



**Carbide-tipped blades** will prevent edge-chipping. Check your component dimensions before making front panel cutouts.



**Finish your surface cuts** with a hand saw. Snake a coat hanger through the cut to support the panel and prevent splitting.



A **radial-arm saw** is almost essential for this project. You can set up jigs for repetitive side panel cuts and hinge mortises.



**Offset hinges** make a secure, hidden mounting ideal for veneer-plywood doors. Screw slots allow positional adjustments.



**Three washers**, used as spacers to match thickness of the unmortised hinges, keep component panel flush with adjacent doors.



**Self-stick veneer tape** is ironed onto the plywood edges of the speakers. Use a razor blade and combination square to trim.



**Kickspace** is provided at the cabinet base. Edges of the dadoes for the 1/4-in. record separators are covered by veneer tape.



A **continuous 1/4-in. bead** of adhesive holds 1/4-in. mirror panels to the plywood walls surrounding the turntable.

tape, Velcro tabs are stitched to the fold, matching the speaker tabs.

### Cabinet construction

The sleek cabinet is designed to show off your components and hide all your storage. Starting from the bottom, there are two, full-length shelves for record storage. The 1/4-in.-thick dividers serve as a truss-like support system for the weight above. Next comes a 6-in.-high, full-depth storage area. The fold-down door can serve as a work surface for sorting or splicing tapes. Inside there's room for headphones, microphones, cleaning equipment, instruction booklets and other small items.

Above this is the main component board. Glue and clamp this carefully. You can add glue blocks and screws

from the inside for extra support. On the right we mounted a front-loading cassette deck. The Pioneer model CT-9191 has a full array of recording features, including a Dolby noise reduction system and a nifty pushbutton release for the cassette cover door. Above it is a Marantz 2235B stereo receiver. With enough power to drive the speakers, the combination amplifier/tuner will also save space. To the left is a Dual 1249 turntable. The critical controls (including cueing bar) are mounted toward the front, making it unnecessary to build a pull-out drawer.

To increase visibility, we surfaced the interior of the turntable opening with mirrors and added a pencil fluorescent fixture. This elegant extra makes the whole unit look like a

million dollars at night. Above the components is another 6-in. storage section. But behind this door we mounted a series of cassette holders made by 3M. On each one, a touch of the button releases a spring-loaded drawer and a tape pops out, ready to load. Above the tape door (which you can hinge to fold up or down) is another shelf for record storage.

You can use touch latches (push on the door and it opens) or magnetic catches and pull knobs. Concealed hinges will highlight the striking effect you can get by cutting the sections of the cabinet front from one piece of plywood. The continuing grain, running from one panel to another, will help make the cabinet a beautiful addition to your living room.

★★★



# Laminating: the fine



Everyday objects take on a striking new look when made of wood

PM photos: Cosimo

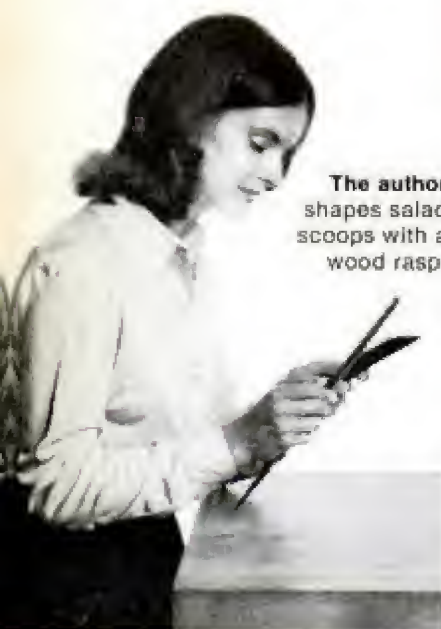
**C**ombining two or more woods into laminations can produce surprising patterns and color blendings. Laminating also offers a chance to experiment with small amounts of exotic woods that would ordinarily be too expensive.

To prepare the laminate, glue the wood pieces together with a thin, even coat of liquid hide, epoxy resin or other wood glue. Clamp the wood tightly with bar or pipe clamps to form a "blank." Place scrap wood on either side of the blank to protect it from clamp marks.

After the glue has cured, plane the blank smooth and saw, carve or lathe-turn it to form the object. Sand it smooth with coarse, medium and fine sandpaper, then apply your finish.

Be sure all mating surfaces are smooth and totally free of imperfections and dust. Purchase dressed lumber.

The first project is on the opposite page. The remaining five projects follow.



The author shapes salad scoops with a wood rasp.





# art of layering wood

laminations. Here are six handsome projects. by Penelope Angell ASSISTANT HOME AND SHOP EDITOR

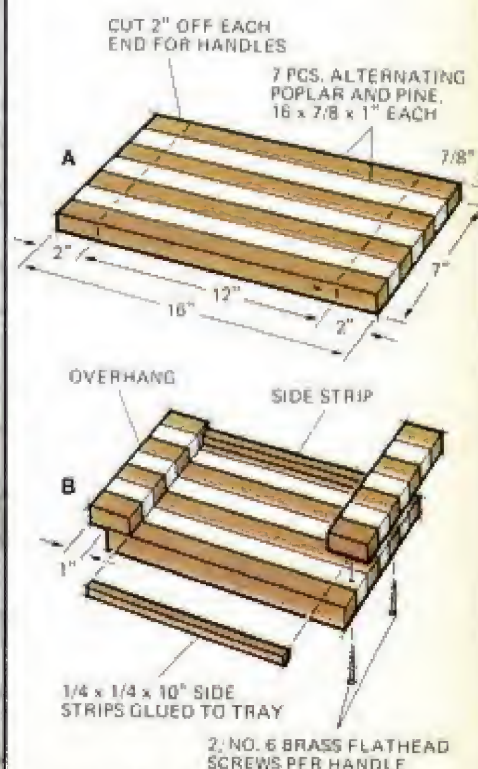


## 1. Fancy tray

The handles of this poplar and pine tray are cut from the ends of the tray blank to give a continuous pattern effect. The sides are strips of poplar.

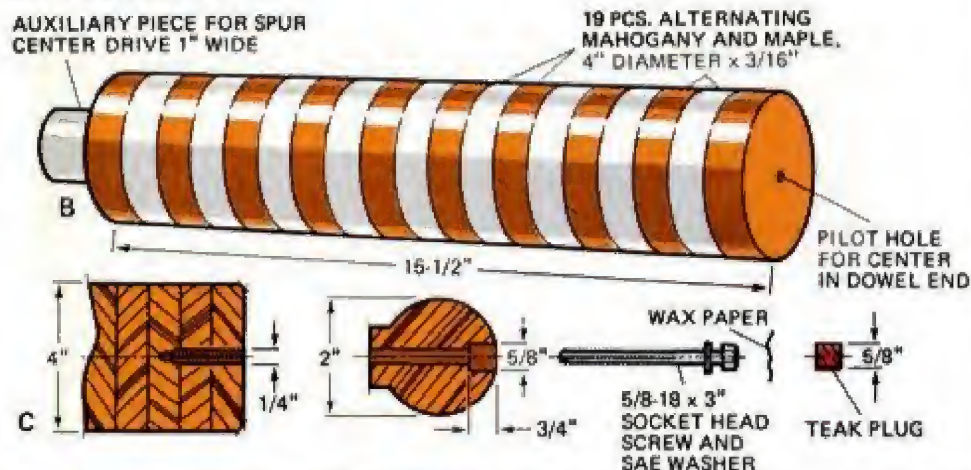
**Materials:** 4 pieces of poplar and 3 pieces of pine, each 16 x 7/8 x 1 in.; 2 strips of poplar, each 10 x 1/4 x 1/4 in.; glue; 4 No. 6 brass flathead screws, 1 1/8 in. long; sandpaper (3 grades); vegetable oil.

**Method:** Prepare the laminated blank with alternating 16-in.-long pieces of wood as explained on the facing page. After the glue has dried and the wood is planed smooth, saw 2 in. off both ends of the blank for the handles. Attach the handles to the tray with screws by predrilling two holes in the underside of each handle approximately 2 in. from each side. The handles should have a 1-in. overhang. Mark screw placement 2 in. from both sides on the underside of the tray, then countersink them. Glue the poplar strips to the tray sides. Sand smooth, then finish with oil.





## 2. Rolling pin



Use a dowel as an axle to sand the discs.

This rolling pin is made of maple and teak discs turned on a lathe.

**Materials:** 10 maple and 9 teak discs each 4 in. in diameter by 13/16 in. thick; 2 1/2-in.-square teak stock about 8 in. long; glue; 1/4-in.-diameter dowel; 2 socket-head screws 5/8-18 x 13 in. and SAE washers; sandpaper; wax paper; peanut oil.

**Method:** On a jigsaw cut out the 19 discs. Drill a 1/4-in. center hole in each (A). Using a dowel as an axle, individually sand the disc edges. Cut the dowel to equal the combined thickness of the discs plus 1 in. Slide the discs onto the dowel and glue together with an auxiliary piece of wood to serve as the spur center drive (B). (You may want to enlarge the disc holes to 9/32 in.) When dry, lay out the center on the drive piece,



The rolling pin is ready to be assembled.

mount and turn. Remove the auxiliary spur drive and clean the glue from the rolling pin end. Turn the teak stock to a 2-in. diameter and saw crosswise in half for the handles. Drill pilot holes through both handles and make a 5/8-in.-diameter counterbore in one end of each handle 3/4 in. deep. Drill pilot hole to 11/32 in. on each handle. Cut two teak plugs 5/8 in. diameter by 3/4 in. deep. Drill 1/4 in. by 2 in. deep into each roller end and make a 5/16-18 coarse thread tap (C). With a cotton swab place five-minute epoxy glue into the threads in the roller ends, being careful not to get any on the outside face. Add wax paper over the screwheads or the roller may not rotate. Assemble using PVA (polyvinyl acetate) glue for the plug (D). Finish with oil.

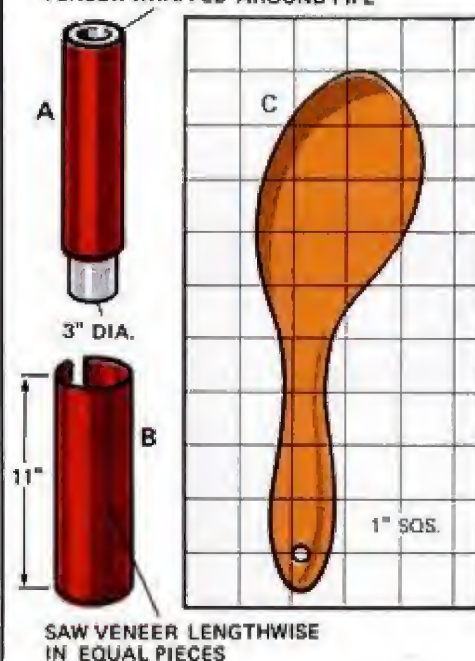
## 3. Salad scoops

These salad scoops are made with five layers of reddish Padouk veneer.

**Materials:** 5 pieces 9x11-in. veneer 1/28-in. thick; casein glue; lead pipe about 3-in. diameter and 11 in. long (or other cylindrical form); rubber strips for clamping (from an inner tube or rubber gloves); 2 6-in. pieces of leather lacing; vegetable oil.

**Method:** Cut the veneer pieces, then sponge with water until pliable. Glue them together with an even coat of glue. Clamp the veneer around a pipe, securing it with the rubber bands until the veneer is dry. It will form a nearly complete cylinder (A). Remove from pipe and saw into two equal pieces (B). Trace the full-size pattern (C) on a veneer piece and saw to rough shape with a coping saw. Trace pattern on reverse side of paper as guide for second scoop to produce a right and left-hand scoop. Refine with wood rasp. Sand, then oil. Drill holes for leather hangers.

VENEER WRAPPED AROUND PIPE



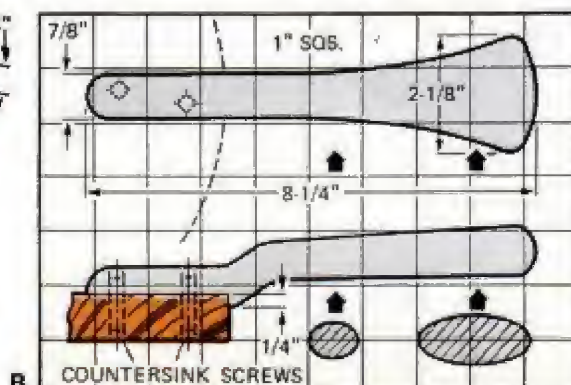
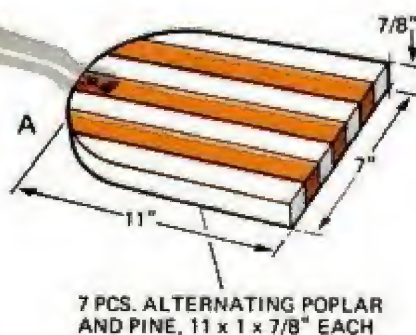
## 4. Breadboard

This poplar and pine breadboard has a handle carved from walnut.

**Materials:** 4 pieces of poplar and 3

pieces pine, each 11 x 1 x 7/8 in.; 1 piece of walnut 10 x 2 1/2 x 2 3/4 in.; glue; sandpaper; 2 No. 6 brass flat-head screws 1 1/4 in. long; mineral oil.

**Method:** Prepare laminated blank with alternating wood pieces. After the glue has dried, plane smooth. Rough-shape the handle end of the board with a saw (A), and sand smooth. Rough-shape the handle with a saw (B). Round with a 1/2-in. wood gouge and a wood rasp. Sand smooth. Join handle and board by carefully predrilling screw holes in the underside of the handle, marking off screw placement on the underside of the board and countersinking them. Finish with oil.



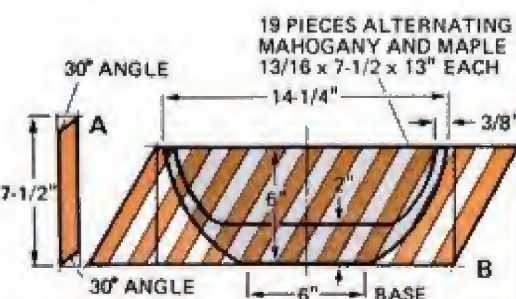


## 5. Striped bowl

Angled mahogany and maple pieces form a striking pattern.

**Materials:** 10 mahogany and 9 maple pieces, each  $13/16 \times 7\frac{1}{2} \times 13$  in.; sandpaper; glue; peanut oil.

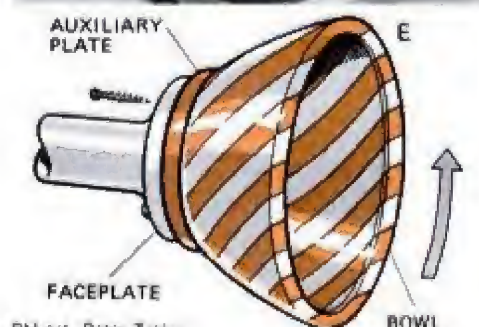
**Method:** To prepare the laminated blank, mark and saw off at  $30^\circ$  angles the ends of the wood on the  $7\frac{1}{2}$ -in. dimension (A). Glue alternate types of wood together and clamp. The laminated blank will not have vertical sides (B). Saw off the slanted sides to form a rectangle (C). Locate the center of the blank. Mark off both center auxiliary faceplate circle and top outside bowl diameter ( $14\frac{1}{4}$  in.) plus  $\frac{1}{2}$  in. on the blank. Use a band-saw to form a thick disc the diameter of the bowl top plus  $\frac{1}{2}$  in. (D). Attach auxiliary plate to faceplate and screw to bowl. Mount on lathe and turn the outside of the bowl. Reverse and turn inside of bowl (E). Sand, then oil.



19 PIECES ALTERNATING MAHOGANY AND MAPLE  $13/16 \times 7\frac{1}{2} \times 13$  EACH

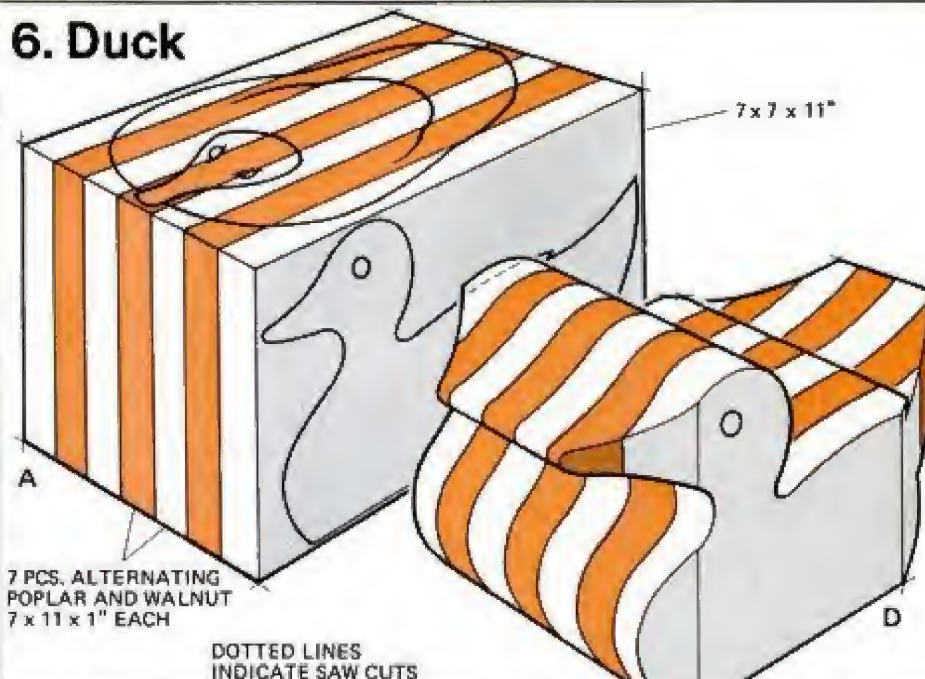


Rectangular blank is bandsawed to form a thick disc equal to the outside diameter of the bowl top ( $14\frac{1}{4}$  in.) plus  $\frac{1}{2}$  in.



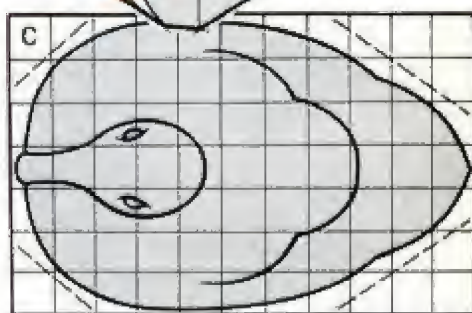
PM art: Peter Trojan

## 6. Duck



7 PCS. ALTERNATING POPLAR AND WALNUT  $7 \times 11 \times 1$  EACH

DOTTED LINES INDICATE SAW CUTS



This poplar and walnut duck is a fine reward for a skilled craftsman.

**Materials:** 4 poplar and 3 walnut pieces each  $7 \times 11 \times 1$  in.; glue; 15-in. square plywood; 2 screws;  $\frac{3}{4}$  and  $\frac{1}{2}$ -in. wood gouges; rasp; sandpaper; linseed oil; butcher's wax.

**Method:** Prepare the laminated blank and plane smooth. Draw the duck on the blank (A). Form the side of the duck by cutting out the rough shape with a crosscut saw (B). Secure the duck to the work surface

while working with the gouges. Fasten it to the plywood square with screws and clamp the plywood to the work surface. Refine the sides with gouges. Redraw and form the top of the duck (C) with saw and gouges. The rough shape of your duck should look similar to the drawing (D). Work toward the back and shape a tail. Then make details. Level bumps and gouge marks with a rasp. Sand smooth. Apply three coats oil. Remove excess oil and apply wax.

### FOR MORE INFORMATION ON LAMINATING

#### Books

- Glenister, S.H., *Contemporary Design in Woodwork*, Vols. 1, 2 and 3, John Murray, London, 1968.
- Nilsson, Ake R., *Woodware*, Drake Publishers, Inc., New York, 1973.
- Piepenburg, Robert E., *Designs in Wood*, Bruce Publishing Co., New York, 1969.

#### Organizations and schools

- American Crafts Council, 44 West 53rd St., New York, N.Y. 10019; maintains Museum of Contemporary Crafts at 29 West 53rd St., New York.
- National Woodcarvers Assn., 7424 Miami Ave., Cincinnati, Ohio 45243; for amateur and professional woodcarvers; publishes bimonthly bulletin.
- The Woodsmith's Studio, 142 East

32nd St., New York, N.Y. 10016; classes in woodworking, wood finishing and carving.

#### Sources of exotic woods and tools

- Albert Constantine and Son, Inc., 2050 Eastchester Rd., Bronx, N.Y. 10461.
- Craftsman Wood Service, 2727 South Mary St., Chicago, Ill. 60608.
- Sculpture House, 38 East 30th St., New York, N.Y. 10016.
- Woodcraft Supply Corp., 313 Montvale Ave., Woburn, Mass. 01801.

#### Wood manufacturers' tour

- Kennedy Brothers, 11 Main, Vergennes, Vt. 05491; specializes in wood wall hangings. Gift shop; factory open to 4 p.m. weekdays.



# 4-in-1 workhorse is molder, planer, edger and jointer

**T**he manufacturer of this unique molder-planer calls it a tool that's second only to a table saw. After having put it to the test, I can see why—I found it to be a real workhorse and as versatile as a one-man band.

Not only is it a molder and a thickness planer, it's a jointer and edger as well. And with the tool's open-side design, the 7½-in. cutter head can surface a board up to 14 in. wide. Just reverse the board and pass it through a second time.

The machine comes in both hand-feed (\$248) and power-feed (\$390) models, and has an output capacity of 15 ft. per minute. It's a veritable planing mill in that it can be used to convert waste and rough-sawn material into dressed lumber free of wave and chatter marks. It's made by Williams & Hussey Machine Corp., Milford, N. H. 03055.—*Wayne C. Leckey, Senior Editor, Special Projects*



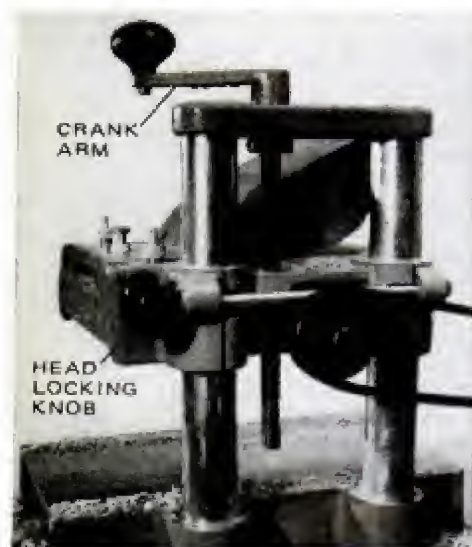
PM photos: Stephen Fay



Wood blocks clamped to machine's fixed table are used to guide work straight under feed rollers and cutter head when jointing or molding top edge.



Alignment strips clamped to base keep stock passing straight under twin molding knives. Cutter head turns at 7000 rpm, requires 1-hp motor and 5-in. pulley.



Crank arm moves both cutter head and infeed and outfeed rollers up and down to suit work's thickness or width.



Husky capscrews in tapped holes lock two high-speed steel knives securely in milled shoulders of 1½-in.-sq. arbor.



Slotted knives can be removed in minutes for sharpening or switching to molding knives; 41 sets of knives are available.



Tweedsmuir Provincial Park, British Columbia, Canada

# Canada at its best.

Share some tonight.



Try the light, smooth whisky that's becoming America's favorite Canadian.  
Imported Canadian Mist.

IMPORTED BY BROWN-FORMAN DISTILLERS IMPORT COMPANY, N.Y., N.Y., CANADIAN WHISKY—A BLEND, 80 OR 86.6 PROOF, © 1976.



# The New Chevrolet. More of the

## More mileage.

Compared to the standard V8 on the 1976 full-size Chevrolet wagon. And a 22-gallon fuel tank gives you cruising range.

# 20 16

MPG Highway MPG City

EPA estimates: 20 mpg highway, 16 mpg city with the new standard 305 V8 engine, automatic transmission and standard rear axle. Actual mileage may vary depending on the type of driving you do, your driving habits, your car's condition and available equipment. California EPA mileage ratings for the 1977 Caprice Classic and Impala Wagons are 17 mpg highway, 13 mpg city with the 350-4 V8 engine (required in California) and automatic transmission. The 305 V8 is not available in California.

## A 3-way door-gate.

It drops down as a gate for cargo loading, or opens out as a door with the window up or down to let passengers in and out of three-seat models.



## Roomy cargo compartment.

The New Chevrolet cargo compartment is well thought out to take loads up to four feet wide through a rear opening that's wider at beltline and higher overall.



## A well-appointed interior.

Soft, cut-pile carpeting throughout. Richly patterned, neatly tailored vinyl upholstery (or cloth and vinyl, if you'd rather). Smart wood-grain vinyl accents in all, a high degree of finish.



## More manageable in city traffic.

Compared to full-size 1976 Chevrolet wagons. The New Chevrolet is more manageable. The turning circle, curb to curb, is 3 feet shorter.



## New corrosion protection.

Special metals, a zinc-rich primer, aluminized wax spray and a bright, deep acrylic finish help keep the beautiful Body by Fisher beautiful.

Now that's more like it...

GM



# things you want in a wagon.

## Quick, easy seat conversions.

A lever releases the folding third seat back. A button high on the side panel (shown below) lets the second seat back fold forward. It takes but seconds.



## Lockable storage in the side.

Over two cubic feet in the side. Handy storage trays hold things that usually clutter seats and floor.



## ...and under the floor.

Another 4.7 cubic feet under the cargo deck on two-seat models, to keep valuables locked up tight and out of sight. (Less on three-seat model shown.)



## Eliminates excess inches or ounces.

This is a wagon clearly more efficient in its use of space, fuel and other materials. And you'll never appreciate that more than when you slip into a tight parking space.



## All this in a wagon that rides like a big, comfortable sedan.

Naturally, we don't expect you to take our word for this. Hence a personal invitation to you and your family to visit a Chevy dealer and drive The New Chevrolet wagon at your earliest convenience.

The New Chevrolet wagon is quiet, too, thanks to a design that isolates road noise more effectively, and a new resilient, one-piece acoustical ceiling.

There are two distinctive side treatments available: subtle two-toning or the familiar wood-grain vinyl. And, of course, your Chevy dealer can show you a generous list of available comfort, convenience and appearance options.

All comparisons relate to the 1976 full-size Chevrolet wagon.



1977 Chevrolet Caprice Classic Wagon with available Estate equipment.





# Two more ways to be a hero in your own home!



## Fix a broken window

Reach for DAP '33' Glazing Compound to replace cracked or broken window glass. It's the nation's biggest seller. Sets new panes in wood or metal sash with an airtight, watertight seal. Takes paint. Outlasts ordinary putty by years.



## Reduce your heating costs

DAP Butyl-Flex® Caulk seals around doors, windows; fills siding joints where heat escapes. Helps save energy, cuts heating bills. Butyl-Flex takes tough sealing problems in stride—lasts 5 times as long as ordinary caulks.



**The name people know best in home fix-up**

DAP Inc., General Offices: Dayton, Ohio 45401  
Subsidiary of Plough, Inc.

## LASER BEAMS

(Continued from page 98)

at a target that can be adjusted to simulate distances from 50 to 300 meters. Hits and misses register on a nearby scope.

A dozen years ago, speculating on high-energy laser potentials was for science-fiction buffs. A laser then was a cigaret-size ruby crystal discovered in 1960 by Dr. Theodore Maiman at Hughes Aircraft Co. When stimulated by heat or electricity, molecules in the crystal gave up their energy to form intense infrared light that bounced between the crystal's mirrored ends, building energy until it burst through one end. What came out was a concentrated light beam of nearly uniform wavelength (coherent) all headed in the same direction (collimated)—unlike light from a bulb that scatters the whole spectrum of light in all directions. The first lasers handled a fraction of a watt of power—not enough to warm a finger held close under the beam exit.

### Concentration is key

Energy is measured in joules. A laser with one watt of power puts out one joule of energy in one second—flea power. But what fascinated scientists was the way a laser could be made to concentrate that piddling energy into superintense minibundles. At Hughes, a ruby laser delivering two joules could unload all of it in one 10-billionth of a second! That compact bundle of laser light, about an inch long, packed a "zap" of some 20 billion watts—a tenth of all the electric power produced in this country in the same time frame. The incredible pulse could—and did—pierce a 1/16-inch steel plate placed under its exit lens, vaporizing the metal it had replaced with a hole.

Theoretically, such "bullets" of laser light could penetrate almost anything. The "death ray" image was born. Unfortunately, to achieve the power, the zap had to be so short it hardly made more than dents in materials of real substance. But if a laser had a continuous beam...

The breakthrough came in 1964 when Dr. Patel discovered that molecules of flowing carbon dioxide in a tube could be made to give up their energy in a continuous lasing action, and at power inputs far beyond the capacity of solid-state crystals. In 1966, Raytheon Corp., using Patel's ideas, built the first EDL—a CO<sub>2</sub> laser that produced 8 kilowatts of power under electrical stimulation. Three years later at AVCO Everett Laboratory in Everett, Mass., scientists blasted hot CO<sub>2</sub> from a jet

engine through a chamber where it "lased" to produce a beam with 60 kilowatts of power. Dubbed the Gas Dynamic Laser (GDL), its beam was comparable to an entire bank of night ballpark lights riding a single beam the diameter of a pencil lead. In several seconds of running time it could produce several hundred kilojoules of energy. The laser was on its way.

### Different types of lasers

Today, a wide variety of new lasers with odd names pop up in the news with increasing and confusing frequency. It's not that much of a shambles. Most lasers in current use are categorized according to the way in which their "lasing" is triggered, or "pumped." There's thermal, or heat pumping (as in the GDL); electrical pumping (the EDL); and chemical pumping.

Depending on the chemicals used, most "chemical lasers" operate in the shorter wavelengths. Other names may refer to different lasing materials. Some dyes dissolved in liquids will lase—hence, "liquid dye lasers." Each has its advantages and disadvantages, producing particular wavelengths of light, at varying energy levels, for particular uses. A neodymium glass laser, for instance, produces a beam in the X-ray wavelengths, and one day may provide us with three-dimensional holographic X-rays—not to mention nuclear fusion. Dr. Patel's new "spin-flip Raman laser" is a gas laser with a tuneable beam that can emit laser light in a variety of wavelengths by "flipping" its magnetic field.

Uses for all these developments have proliferated in well-defined directions for both high and low energy applications in a number of fields.

Today, at Ford Motor Co., there's a 6 kilowatt CO<sub>2</sub> laser made by URL that's all set to go on the line welding automobile underbodies in a continuous operation. The beam-spouting head travels over the seams at 600 inches per minute, gimballing as it moves to keep the laser beam at a constant right angle to the work. "The beauty of laser welding," says United's laser division chief, Jeffrey Carstens, "is that you can send the beam around corners to where it's needed. If you can see it, you can weld it—with a mirror system. And the beam delivers a high-quality narrow weld in a continuous seam stronger than the original metal."

At General Motors, a six-foot-high laser is cooking the surface of a steel gear that drives the piston in a power-steering assembly, case-hardening the metal with that amorphous melt to minimize wear. "Lasers are

(Please turn to page 134)



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## LASER BEAMS

(Continued from page 132)

ideal for this kind of job," URL's director, Dr. Russell Meyerand, points out." Revolving mirrors can sweep the beam around cylinder walls and valve seats with ridiculous ease."

### Even granite and diamonds

Oil shale recovery and subterranean mining soon may come under the beam. United's big one has been drilling holes and cutting kerfs in the shale, making it easier for smaller amounts of explosive to shatter more ore for removal. The high-energy beam also is cutting slots and punching holes in granite blocks. For penetration of really tough materials—like granite or diamonds—"pulsed" lasers can zap their way through to expedite blasting in deep mines.

This year at McDonnell Douglas, a big production-model, 300-watt infrared laser went on the line slicing F-15 rudder skin patterns from sheets of boron epoxy. The intense beam does in four minutes what used to take manual cutters eight hours. The computer-guided laser head, gliding over a moving worktable, was adapted from Hughes Aircraft Co.'s earlier fabric-cutting laser that does the same thing cutting cloth panels for suits for clothing manufacturers.

Last year, lasers took on the cutting, shaping and sorting of wood. Two West Coast outfits—Coherent Radiation and Sylvania Electronics—have been experimentally cutting and carving tricky patterns for furniture with high-energy lasers. At URL, the Department of Agriculture's Forest Products Laboratory sliced half-inch Douglas fir lumber under a 5-kilowatt beam at 125 feet per minute. A 3-kilowatt laser cut 3/4-inch hard maple at 15.8 feet per minute. "The wood is instantly vaporized," observes F.P.L.'s Curtis C. Peters. "There's a puff of smoke and the end of the board falls off."

While still an expensive tool for woodworking, in some areas lasers pay off. They're cutting ornate slots in 3/4-inch plywood used in making dies for cartons, for instance. Meanwhile, Bendix Research and Spectra Physics are field-testing a laser system that scans softwoods for high-quality millwork. It locates knots and imperfections, and a computer link decides how to rip or crosscut the piece for maximum yield.

### For stomach targets, too

A vastly promising field for lasers is medicine. Besides the beam's well-established function in cataract and retinal operations, the multikilowatt laser has become an ideal surgical

knife that cauterizes as it cuts. In Boston Childrens Hospital, doctors are using a CO<sub>2</sub> laser to remove larynx growths. In 87 cases they had only one remission—successfully corrected the second time around. The beam now is removing tumor cells in mastectomies and cancerous skin growths. And it's snaking down gullets to excise stomach ulcers without the need to cut into the patient. Until now, this has been managed with "articulated arms," an awkward system of mirrors. At an industry meeting last spring, Dr. Elsa Garmire of the University of Southern California, exhibited a flexible metal light-wave guide that will deliver 95 percent of a laser's energy through the one-meter minitunnel to precise targets in a stomach "... as easily," she points out, "as an optical fiber guides visible light." Recently, an enterprising dental surgeon has been experimenting with special laser lightwave guides to direct the beam to his own teeth for possible use in treating dental decay.

The laser's ability to "sense," based on the absorption, reflection or diffraction of its light waves, is making it a first-rate diagnostic tool. University of Rochester scientists are flowing pap smear cells stained with fluorescent dye past a laser beam and measuring the degree of fluorescence in each nucleus. Abnormal cells emit a measurably greater concentration of green light, and are tallied by the laser at hundreds of cells per second—a job presently requiring hours of work.

### Lasers that 'read'

A far-out laser application was attempted recently by General Scanning of Watertown, Mass., a company involved in large-scale displays. Using a laser beam as you might an electron beam in a vidicon camera, and in a TV tube, they tried to scan and then project moving images onto clouds in the night sky. "We put a large UFO on the clouds over Boston during a Red Sox night game," Ed Grenda, a company spokesman, reports. "But there was no panic. Nobody noticed it. We decided laser cloud writing has a dim future."

On the other hand, a four-watt laser projection of moving images on a billboard beside a Boston highway worked too well. "It's no longer allowed," Grenda admits, cheerily. "Too many accidents." General Scanning, he says, will stay with the "sound and light" type of coherent light displays.

In many areas of scanning, sensing and transmitting of information, however, lasers already are performing

(Please turn to page 136)

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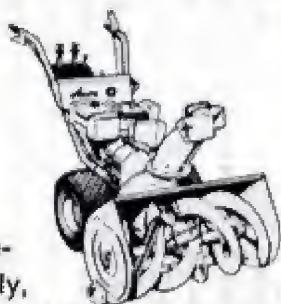
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ing yeoman service. They are reading words and recording them on microfilm at unprecedented speeds. At Philips Laboratories in Briarcliff, N.Y., they are producing and playing video discs for multichannel storage of everything from TV shows to industrial and medical X-rays. At J & B Associates in Santa Clara, Calif., a helium cadmium beam is producing "laser document files" by burning holes in a metal film on discs. Data is retrieved and read by the same beam. In printing plants, lasers are scanning made-up pages and exposing plates for the presses.

Xerox boasts a new "Telecopier" using a laser beam to read and send (or receive and print out) facsimile messages over telephone lines. It operates unattended at twice the speed of the company's other models.

In Chicago, an Israeli company, Gemprints Ltd., is marketing a laser that "fingerprints" diamonds and other gemstones by scanning, sensing and reading out on a screen the distinguishing flaws and inclusions.

Many jobs previously reserved for radar, infrared cameras and the like are being swept up by the laser beam. Recently, the Environmental Protection Agency put an airborne LIDAR (Light Detection and Ranging) system to work bouncing a laser beam off smoke plumes and pockets of smog. By measuring the amount of light that bounces back and its travel time, a computer link calculates in seconds the quantity and location of airborne particles. In a recent test LIDAR mapped pollution distribution on a 35-mile path over St. Louis in 10 minutes.

## For probing ozone layer

Patel's spin-flip laser goes LIDAR one better. Aimed at an air sample, it can be "tuned" to any frequency required to identify the type and quantity of gases in it, according to the light frequencies absorbed by each gas. Nitric oxide, a toxic automobile exhaust component, has been detected at .01 parts per million. "With this laser," says Dr. Patel, "we now can take measurements in the stratosphere to determine the actual effects of SST emissions on the ozone cycle."

A number of new lasers are measuring distance-and-time frames with unprecedented accuracy. A satellite called LAGEOS is reflecting ground-based laser beams back from space to determine minute horizontal or vertical movements in the Earth's crust—a vital tip-off to earthquakes. GTE Sylvania's Precision Automated

Tracking System—a mobile laser packed into a giant van—is ranging and tracking in-flight experimental aircraft. In more mundane pursuits, other lasers are ranging everything from military targets to the slope of new sewer lines.

A new airborne laser for military helicopters, developed by URL, can spot a 1/4-inch communication wire hung in the air a mile away—ample distance in which to avoid it. "Those wires tend to mess up rotor blades," Jeff Carstens explains, "and the Vietcong didn't always string them for phones."

## Work for tiny lasers

One real sleeper in laser technology has been developing quietly behind the scenes for years and will affect all of us shortly. Oddly, the lasers involved are the smallest and most feeble in the business. They are aluminum gallium arsenide "chips" the size of a grain of salt, modulated by electric current drives, and boast a power output measured in the multi-thousandths of a watt. But what they can do is something else. Their size is geared to projection of a laser beam through the end of an optical waveguide the diameter of a human hair. Today they are operating Bell Labs' experimental telephone system in Atlanta, Ga., running signals through 2100 feet of half-inch cable carrying 144 glass-fiber "lightguides," from which other optical fibers extend in a laser-driven network several miles long.

The service is compatible with regular equipment. Each pair of lightguides can carry 672 phone calls simultaneously, and the system can handle up to 50,000 simultaneous conversations. Purity of glass in the new optical waveguides, developed at Corning and Western Electric, enables signals to travel four miles before a boost is needed. And there's no interference or crosstalk. The Atlanta test bed is designed to prepare the new laser-driven optical technology for widespread use in the Bell System by the early 1980s.

Other exciting roles for lasers may be just over the horizon. At AVCO, scientists are trying to enrich uranium fuel—separating U-235 from unfissionable U-238, using a laser-triggered excitation technique. If it works, fuel for our nuclear powerplants will cost far less than with the elaborate gaseous diffusion process currently used.

Further in the future, perhaps, is a laser fusion process. At the University of California's Lawrence Livermore Laboratory, and at the University of Rochester, N.Y., scientists have been trying to trigger

the energy of the hydrogen bomb with ultrahigh-energy lasers that—for one incredible instant a tenth of a billionth of a second long—reach 600 million kilowatts of power in a beam that is 100 billion times brighter than sunlight on Earth's surface. The object is to hit a pellet of nuclear fuel with converging pulses of those beams, with enough power to create a compacting event in the pellet so intense that it will initiate a fusion reaction.

Laser engines also may be on the way. At Westinghouse Research Laboratories, scientists have been shooting laser light through sapphire windows in cylinder walls to expand gases in modified reciprocating engines. Since the lasers generate temperatures of 6000°C. in millionths of a second, the rapid expansion of the gases in the closed system theoretically will produce twice the power of fossil-fueled engines. At least one such experimental laser engine has been operating for a year or more at a NASA laboratory.

## Aiming at the future


And there's still some "Buck Rogers." At a recent laser conclave, visionary researchers proposed Volkswagen-size capsules riding into space atop steam-boiler rocket engines fired by superhot ground-based laser beams. More conservative minds point out that we have all the technology to do the job—except the beam, and the weather control (so far we can't make laser beams penetrate clouds, which is very embarrassing).

As for those long-range "death ray" weapons, except for a few "fast zap" applications already discussed, the "vaporizers" probably will have to continue functioning in the labs for a while. Scientists reveal that it would take 100 kilojoules to punch a hole through sheet aluminum six miles away, and about 500 gallons of fuel for one zap 100 picoseconds (a tenth of a billionth of a second) long. Since we have a few problems getting up to 10 kilojoules in the same "zap time," long-range death rays are likely to be a long-range proposition.

But maybe not as far off is a recent proposal by scientists at Los Alamos and Albuquerque that lasers of great power may one day be "fired up" directly by nuclear reactors. Electrons emitted by fusion would excite the laser gas, they said, converting its electrons directly to laser light. Such nuclear-powered lasers could, say the seers, be orbited in space to light whole cities at night.

Don't hold your breath for that application, either. ★★★



A full-page photograph of a soldier in green combat uniform and helmet, rappelling down a thick rope. He is smiling and looking towards the camera. A rifle is slung over his shoulder. The background is a grassy field.

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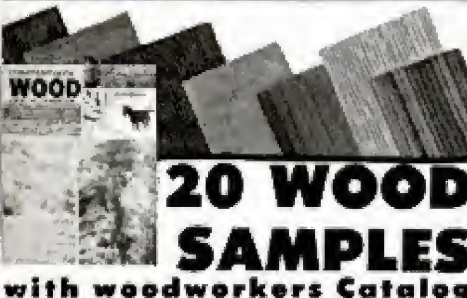
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## A YANK TANK

(Continued from page 75)

developed the XM-803, which Congress refused to fund anymore when the cost neared \$1 million per tank.

The XM-1 project was authorized by Congress in late 1971 and contracts were given to Chrysler, manufacturer of the M-60 series, and General Motors. Instructions were clear. A new main battle tank prototype was to be designed for the production of a tank to cost \$507,000 per copy in 1972 dollars. The XM-1 was to weigh 58 tons and mount a 105-mm main gun and two or more complementary armament systems with improved fire control and shoot-on-the-move capabilities. Improved ballistic protection, a new super-tough armor that's presently classified SECRET, would allow the XM-1 to safely engage targets at shorter ranges than current tanks with increased first-round kill capability.

The new armor, developed by the British and reported to be a composite material made by a process blending ceramics and metal, has 100-percent more stopping capability than the armor on the M-60.

"Antitank rockets and other types of armor-piercing ordnance almost bounce off this new armor plate," said an Army engineer following tests last July.

## To make it a tough target

The Army also demanded that the new tank be capable of "higher cross-country speeds and faster acceleration to make the XM-1 a more difficult target for opposing ground and air forces."

The Germans, meantime, had launched their own tank development program following the demise of the MBT-70 joint project with the United States. They also entertained ideas about producing a standardized tank for NATO. The final result was the Leopard II, a fast, sophisticated weapon with a 120-mm main gun. It points up the different outlooks of American and German tank experts.

German tank doctrine leans toward a heavy gun for a long-range capability against enemy tanks and fortified positions. American doctrine, based on a combined air-infantry-armor effort, calls for a shorter-range weapon—such as a 105-mm gun—for closer engagement of the enemy.

In any event, during the development of the XM-1, the United States agreed to consider the Leopard II as an entry in the MBT (main battle tank) sweepstakes. After all, the Germans had purchased the made-in-America M-48 and the Lockheed

F-104 Starfire, an ill-fated fighter with a penchant for crashing.

Having promised that the Leopard II would be considered as a battle tank possibility, the United States said that the tank would be tested against the two XM-1 prototypes.

But a proviso was thrown in: Bonn would have to send an "austere version" mounting a 105-mm gun. The modifications would bring the cost of the tank more in line with that of the XM-1. The standard German Army Leopard II runs close to \$900,000 a copy.

Whatever its final configuration, the new battle tank is keenly awaited by our tank troops.

"It was quite an experience," explained Lt. Col. William H. Roche, a tank officer throughout his 17-year Army career, as he recalled a ride in the XM-1. "The new suspension system permits a much better run across bumpy terrain—and three times as fast. I could damn near drink a cup of coffee without spilling a drop while riding in the XM-1."

## Just like a sports car

We were talking in the South Korean tank park of the U.S. Army's Second Infantry Division, The 1/72nd Tank Battalion, under Col. Roche's command, is the only on-the-line American tank unit on the Asian mainland.

Driving the XM-1 is like driving a sports car, explained Spec. 4 Louis Rivera, a tank driver who had been assigned to the Armor and Engineer Test board at Fort Knox, Ky., the Army's tank/armor headquarters. He was one of four enlisted men sent to Detroit to drive the prototype models and confer with engineers.

"I couldn't believe the pickup and power of the GM model," he recalled. "I had it in reverse and almost ran over a mechanic. That's how fast it moves. But the driver in the XM-1 is more confined than in the M-60. The new tank is compartmentalized with armor plate to protect the crew if a hit is made in the fuel tank or in the ammo storage areas. It's like being in a little cockpit and it took a bit of getting used to."

"As for the Chrysler model, it is just as fast and can do 35 mph cross-country. The engine is a bit quieter because it's a multifuel regenerative turbine instead of a diesel. The engineers told me that this kind of engine can operate for 12,000 miles without requiring a major overhaul, which is three times better than the M-60 engine. But I think the most important factor, from the crew's standpoint, is that 65 percent of the normal maintenance on the

(Please turn to page 142)



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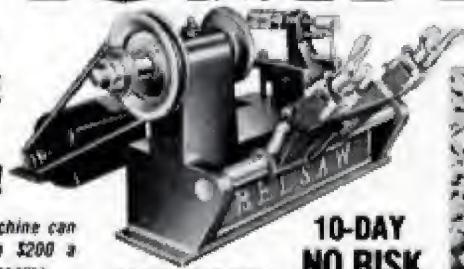
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Sam Walker, Prichard, Alabama



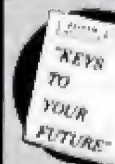
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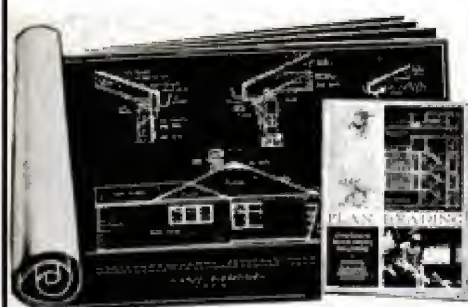
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Your faithful wife-navigator may be right most of the time—An Airguide auto compass is right all of the time. Versatile adhesive mount. Self-illuminated. Adjustable compensators. Model 1601. Available at retail auto stores. Write for catalog 67A. Jobber and dealer inquiries are also invited.

**Airguide**  
2210 Wabansia, Chicago 60647

## A YANK TANK

(Continued from page 140)

engine can be done without removing it."

Last summer, when the two prototypes were being tested against each other, the need for further modifications appeared on the horizon. A new "memorandum of understanding" between the U.S. and West German governments called for the standardization of certain key components. The heavier, longer-range 120-mm gun would be used on the XM-1 as well as the Leopard II and both tanks would be powered by the American-made, 1500-hp turbine engine designed for the Chrysler.

The XM-1 design that may be selected before the end of 1976 and all the Leopard II tanks will be manufactured with the common gun and engine. Also, according to the memorandum between the governments, the two tanks will incorporate the American-developed day/night sight with improved night vision capability; a German-made gunner's telescope; standard metric fasteners requiring only one set of tools on board each tank; a common track.

### Lessons from war

In this first step toward a higher level of standardization of NATO weapons, Secretary of the Army Martin R. Hoffman, at a news conference announcing the additions to the original German-American agreement, disclosed that the 1973 Middle East war had a lot to do with the decisions taken. "Part of the considerations of combat effectiveness are logistical support," he declared, "including that ultimate dimension . . . the ability to cannibalize on the battlefield."

With NATO armies using both the U.S. and German tanks with compatible guns, engines, tracks, tools, ammunition, fuel and other equipment, any tank knocked out in battle automatically serves as a source of supply in repairing temporarily disabled tanks. (Armies of the Soviet bloc already have this ability.)

The new memorandum sent General Motors and Chrysler engineers back to the drawing board to redesign XM-1 turrets to accommodate both the current 105-mm and future 120-mm guns and adapt their blueprints to conform to the new additions to the original 1974 agreement between the U.S. and Germany.

Meanwhile, the U.S. Army's tank experts will be taking a hard look at the Leopard II's performance, which will be measured against the track records of the two American prototypes. The base line of measurement

is the M-60 series tank of which the M-60A1E3 is the latest model. The differences between the old and new American tanks are these:

Combat-loaded weight of the XM-1 with 105-mm gun is 58 tons (60 tons with 120-mm gun); the M-60 weighs in at 57.3 tons. XM-1 height to turret roof is 95 inches, 33 inches lower than the M-60's. At 25 feet, the XM-1 is almost 3 feet longer.

The GM prototype is powered by a 1500-hp, 12-cylinder, air-cooled, turbo-supercharged diesel; the Chrysler has a 1500-hp regenerative turbine engine. The M-60's engine has about half the horsepower of the XM-1.

The XM-1's range is 300 miles without refueling as against 280 miles for the M-60. The XM-1 can do 48 mph on roads and 30-35 cross-country. Comparable speeds for the M-60 are 30 and 12 mph. The XM-1 can climb a 10% slope at 20-25 mph as against 10-12 mph for the M-60.

### Sophisticated firing system

The prototypes and the M-60 are all mobile gun platforms with, of course, a far superior suspension system for the XM-1. However, both prototypes and the latest M-60 incorporate a laser rangefinder, a full solution digital computer and an improved day/night vision sight. The XM-1 stabilization system permits accurate shooting on-the-move. In a typical firing mode, the gunner selects his target, uses the laser to determine the correct range and the computer for firing adjustments. Then he presses the firing switch.

Secondary firepower will be provided by a 7.62-mm machine gun, two 50-cal. machine guns and a high-velocity grenade launcher.

As a fighting machine, the XM-1 is without peer, according to the men who have designed and tested the two American prototypes. But it's a machine that will cost, at the time of delivery in the 1980s, at least \$1,090,000 a copy, according to Army Secretary Hoffman. That is why some Congressmen are up in arms over the tank program. They see no sense in spending a fortune on a weapon that may be obsolete. For the price of one XM-1, two late-model M-60s can be bought.

Other legislators are equally unhappy about the delay caused by the decision to explore the possibility of using common components for the new American and German tanks. Representative Mel Price (Illinois), chairman of the House Armed Services Committee, told newsmen: "We've been fighting a long time for a modern tank and this means one more delay of unpredictable duration. It could be critical." ★★





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When it's warm, inviting, lightweight,  
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In tan, red and white at your  
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*Room design by Larry Deutsch, A.S.D. Man-made finish on real Masonite hardboard.*



# ANNOUNCING THE NEWEST PONTIAC

For 1977, we started from the ground up and created two wagons designed specifically for the changing needs of today's changing world.

Grand Safari. And Catalina Safari.

We made them trimmer without trimming away the good things you buy wagons for. So they're very space-efficient wagons.

## **SURPRISING NEW ROOMINESS.**

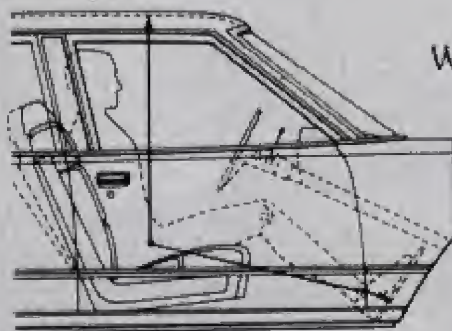
87.3 cubic feet of roominess. Enough

roominess with tailgate closed and front seat forward for a whole flapjack stack of 4' x 8' plywood. Or whatever else you may want to carry.

Should that whatever be people, a lot of those 87.3 cubic feet convert nicely to headroom and legroom. Enough for eight adults if you order the new rear-facing third seat.

Our new interiors were also designed realizing that adults like things that help make their lives more enjoyable.

So the upholstery is new. The carpeting is new. The appointments are new. And the instrument panel is new. We even raised the gauges so they're easy to read.

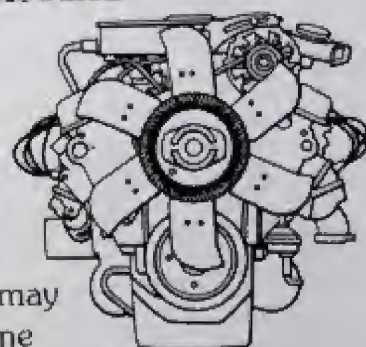


## **AMAZING NEW 5.0-LITRE V-8... GREAT NEW PONTIAC RESPONSE.**

It's really new.

A 5.0-litre (301-CID) 2-bbl. V-8.

Smooth, quiet and responsive. So responsive you may have a tough time deciding between it and the 6.6-litre (403-CID) V-8 that's available.

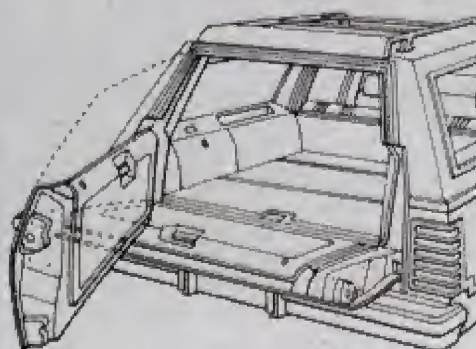


Whichever, you'll get Turbo Hydra-matic standard. Variable-ratio power steering. Standard. Power front disc brakes. Standard. And Pontiac's Radial Tuned Suspension with steel-belted radial tires. Standard.

## **SUPER NEW 3-WAY TAILGATE.**

1. It opens like a door with the window up.
2. It opens like a door with the window down.

3. It pulls down like a tailgate with the window down.  
So get your grocery bags, kids and 2-by-4s ready. Pontiac's ready for '77.



## **FROM SEATING TO CARGO AND BACK AGAIN. ALL NEW.**

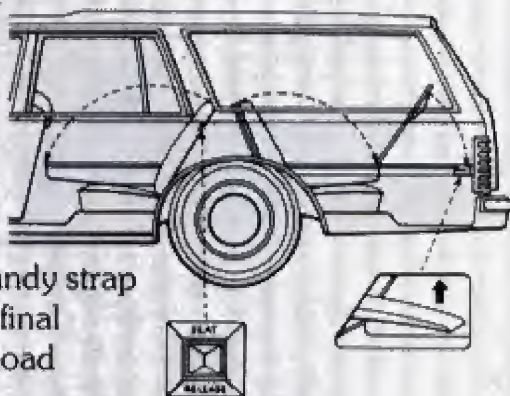
Push a button. Safari's second seat does a disappearing act. Flip a panel, lift, and it's back.



# WAGONS SINCE WIDE-TRACK.

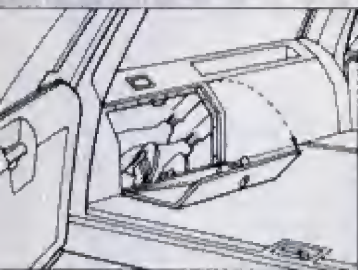
The available third seat is equally easy. Flick a lever, it releases.

Push down to lock. Use the handy strap to pull over the final panel. And the load floor's flat.



We also built in two new lockable storage compartments. One's in the rear quarter panel. The other's under the rear cargo floor.

Together they carry 6.8 cubic feet of stuff you don't want to advertise.



## NEW CORROSION PROTECTION, NEW EQUIPMENT AND MORE.

We came up with whole new wagons. Naturally we wanted to protect them.

So we put more corrosion-resistant materials in the body and chassis than ever before. We put in diagnostic connectors to help your dealer analyze electrical problems. And we put in a new maintenance-free battery.


That's what we did for your Safari.

There's a lot more you can do. Like add CB radio. Add an adjustable roof rack. Add automatic level control. Add automatic temperature control air conditioning. Add a limited-slip axle. Add an AM/FM stereo radio that features a digital frequency readout and a digital time readout. They're all available from Pontiac's list of accessories.

Just so you can have a full-sized station wagon tailored specifically for you. Buy or lease a 1977 Pontiac. Soon.

\*N.A. in California and high altitude counties.



**PONTIAC**  **THE MARK OF GREAT CARS**

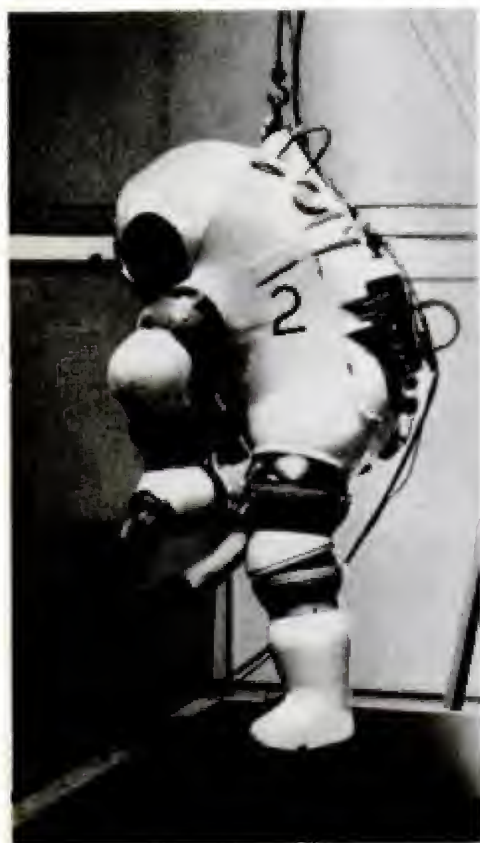


# The 'iron man' dives to 900 feet

by John F. Pearson



The JIM suit's tough test came in a series of dives in 915-foot water at a drilling site near Melville Island, 600 miles north of the Canadian mainland. The drilling rig (above) sits on island of ice 16 feet thick. Plywood "snowshoes" were fashioned for the suit (right) after divers reported sinking 12 inches into the soft bottom at each step. The snowshoes worked well. Four dives, totaling 15 hours of "bottom time," were made in the 27.4°F. water. Below: Tether lines help diver move around on platform. In air, bulky suit weighs 910 pounds.



If you met JIM in a dark alley, he'd scare you to death. JIM stands 6 feet, 6 inches tall, weighs 910 pounds and has metal claws for hands. He looks like an escapee from a robot farm.

But JIM is nothing of the sort. He's a diving device, little more than an empty shell until a man climbs inside. Still, it's natural to think of JIM as a "he," and I'll refer to him that way in this article. He is named after a mechanic-diver instrumental in his development.

JIM is a one-atmosphere diving system designed to be used at depths of 1000 feet and more, where divers in standard gear can't operate. Such deep work now calls for "saturation" diving. Divers must be taken down in a pressurized bell, wear heated suits and breathe special mixtures of gases that saturate body tissues, displacing air. Topside, they must be backed up with decompression chambers and other sophisticated equipment. It adds up to an expensive operation.

Currently available alternatives

include small subs with manipulator arms and unmanned underwater vehicles. But they're limited in what they can do.

JIM is now offered as another choice for deep work in the world's offshore oil fields. JIM is the simplest of all the systems—basically, a rigid diving suit with articulated arms and legs. The suit is made of a magnesium alloy and has fiberglass components.

## No compression needed

Because the suit can withstand the extreme pressures of deep water, the diver breathes air at normal atmospheric pressure, which provides a big advantage over saturation diving. The saturation diver must be compressed in a chamber for hours before a dive and must be decompressed for a period of days after he comes up. The JIM diver can go down immediately and simply step out of the suit when he's back on deck.

JIM is far from a new idea. Rigid,

(Please turn to page 148)





## Which one offers you more?

Take 5 minutes to complete this little quiz.

It compares three of the best places where you can buy property and casualty insurance.

With the correct answers (which are printed below), you can save time and money.

And assure yourself the best protection and service.

**A SF TIS**  
☐ ☐ ☐ **Which one offers you a choice of many leading insurance companies?**

Allstate sells Allstate Insurance.

And State Farm sells State Farm Insurance.

But The Insurance Store offers you a wide variety of insurance companies—including ourselves, Continental Insurance.

Some of the companies specialize in automobile insurance. Others, in homeowners insurance. And still others, in business insurance.

At the same time, some of the companies specialize in low price. Others, in unusual coverages. And still others, in a combination of both.

So whatever kind of insurance you need, by shopping at The Insurance Store, you can select the specific companies and policies that best match your needs.

**A SF TIS**  
☐ ☐ ☐ **Which one offers you the lowest prices?**

Today no insurance company can ac-

tually promise you *the lowest prices*.

Because each company bases its rates on actual experience with specific insurance classifications in specific geographical areas.

And recent studies show that each company's rates vary widely from one area to another.

But because The Insurance Store in your area offers so many different companies—chances are, it has the one company that best suits your needs and budget.

**A SF TIS**  
☐ ☐ ☐ **Which one offers you a unique combined home-and-car policy?**

Only The Insurance Store offers you this unique policy.

It's called the Continental Insurance Personal Comprehensive Protection Plan.\*

And, in fact, it's so comprehensive, it also lets you combine even your hospital, disability income, and mortgage life insurance all into one neat package—with just one premium and one expiration date.

**A SF TIS**  
☐ ☐ ☐ **Which one offers you 24-hour Dial-A-Claim Service?**

Of the three places above, only The Insurance Store can offer you 24-hour Dial-A-Claim Service.

It lets you report an accident from anywhere in the U.S. or Canada—any time, any day, toll free.

And it's backed by over 2,000 claims adjusters.

So whenever and wherever you need help, help is always nearby.

**A SF TIS**  
☐ ☐ ☐ **Which one offers you an independent agent?**

Unlike the agents at Allstate and State Farm, the agent at The Insurance Store is an *independent* agent.

*Independent* means: While he represents many different insurance companies, he's beholden to no one company.

And so if the company with which he places your business doesn't do what's best for you, he's free to switch to another company which will.

That gives him tremendous leverage to use on your behalf. And use it he does.

To find the *independent* agent who runs The Insurance Store nearest you, just see an agent listed under Continental Insurance in the Yellow Pages.

Having completed this little quiz comparing three of the best places where you can buy property and casualty insurance, you now know two very important things:

Which one offers you more.

And why.



**Continental Insurance**  
 featured at  
**The Insurance Store**



# IRON MAN

(Continued from page 146)

one-atmosphere suits were made in England in the early '20s, and related patents go back even further. JIM was developed by an English company, DHB Ltd., but his use in the offshore oil fields is sponsored by Oceaneering International, a big diving company based in Houston.

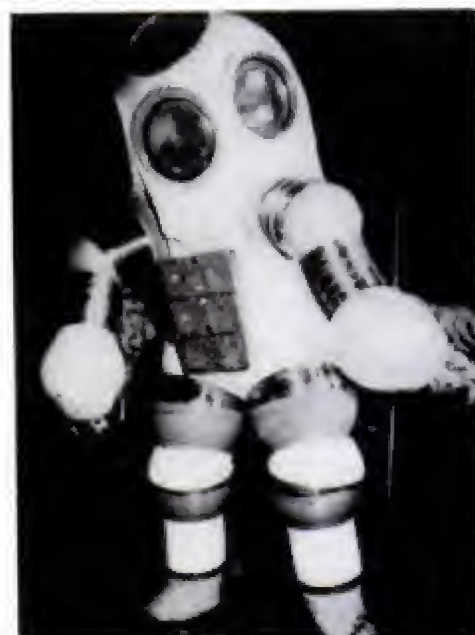
JIM showed what he could do last winter in the inspection of a big mooring tower in the wild North Sea. Divers using the suit totaled 88 hours of bottom time at 384 feet, operating underwater TV and still cameras to provide engineers with a visual record of the inspection.

But JIM's toughest test to date came last spring in the Arctic. The site was a well drilled by Panarctic Oils Ltd. in 915 feet of water. With one man going down at a time, a team of Oceaneering divers spent 15



Greater freedom of movement is afforded by new generation of arm joints on this JIM suit. Ballast weights in front are released from inside.

Photo of diver at work (above) was made from screen of topside video monitor. A TV camera on an unmanned sub provided underwater coverage.



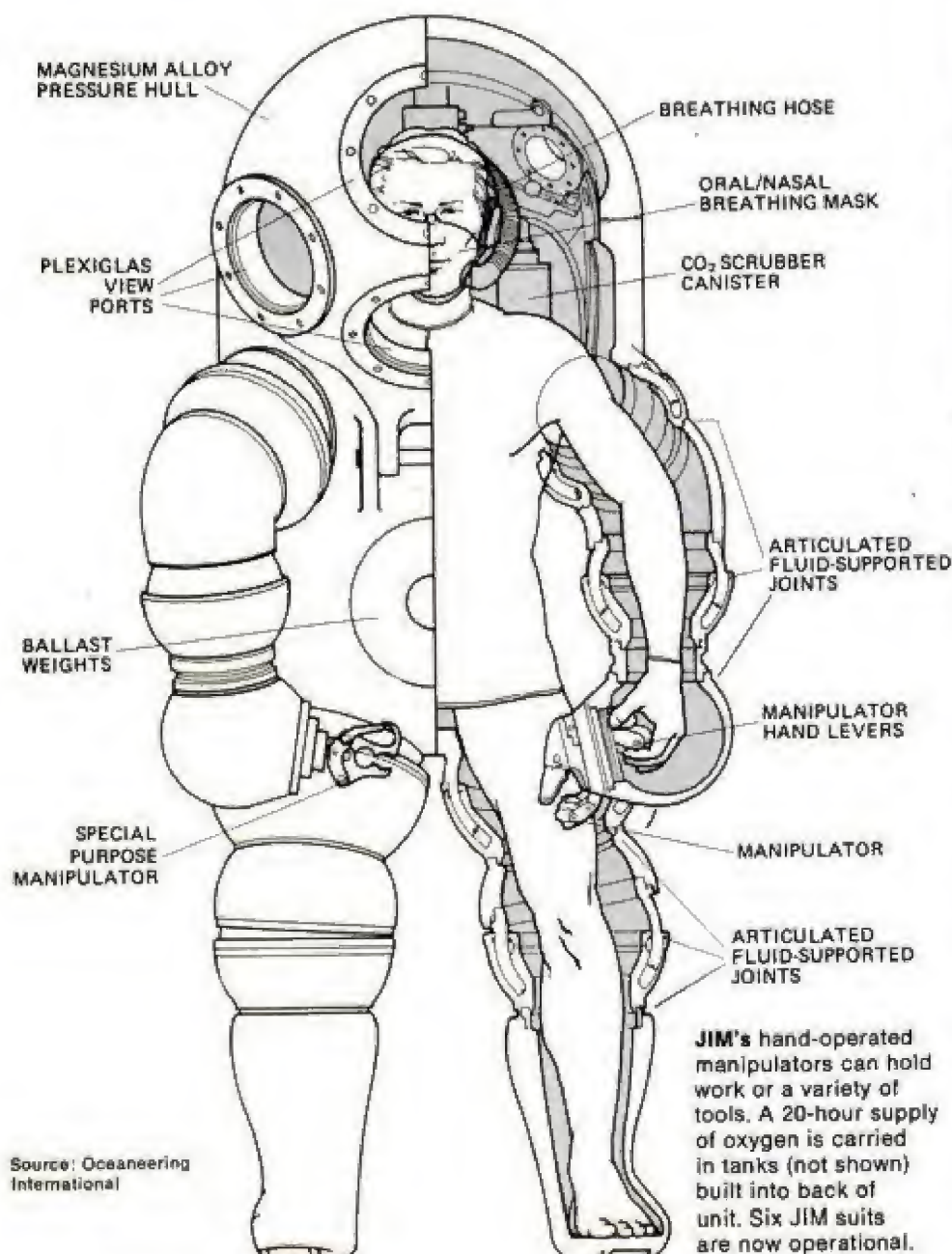
hours carrying out simulated tasks such as connecting hydraulic lines to the wellhead's blowout preventer stack. The test was judged a success.

## System shipped by copter

JIM is easily transported. The complete system—diving unit and a small deck winch and other handling gear—can be rushed to a site by helicopter.

But JIM has his limitations, too. He is slower than a diver in standard gear in performing actual work. He has limited vertical movement and does not function well dangling by his tether in the water. He must have a platform or other fairly solid surface to work from. In addition, murky water hampers operations because tasks must be done visually; divers in standard dress often work by "feel."

But JIM has done so well in his oil field outings that Oceaneering and DHB Ltd. are working on an improved model capable of making 3000-foot dives. ★★★



Source: Oceaneering International



# How to make an ID photo

Identification photos for use on applications, passports, permits and licenses are sometimes hard to have taken for you (they're not profitable for most portrait studios)—but they're easy to take yourself.

The average snapshot won't do, but just follow a few rules to lift your ID photos out of the snapshot class:

- **Backgrounds** should be plain and white—light, unmarked plaster walls will do indoors or large sheets of white cardboard anywhere. (White bedsheets aren't suitable—they wrinkle too easily, and the wrinkles show up in the background unless you take a lot of extra trouble with your lighting.)

- **Distance** should be at least 4½ feet between camera and subject to avoid distortion. Ten feet is still more flattering, but unless you use a short telephoto lens, you may have to order a large print to get a big enough head size at that distance.

- **Lighting** should be soft and simple—bounce light

indoors, open shade or overcast skylight outdoors.

- **The print** should be made on matte or semimatte-surface paper, especially if it will have to bear a signature. But if you can't have a matte print made, get a glossy one and spray it with dulling spray from a photo, art or drafting shop.

- **The pose** need not be dead straight on or the expression as grim as on the mugshots on the post-office wall; a slight turn of the head and relaxed smile are permissible and pleasant.

—Charles Smith



A simple background, such as the white cardboard taped to the wall above, accounts for some of the difference between a mere snapshot (far left) and a good ID photo (left). Soft, even lighting (here, a wall in open shade), the right distance and a relaxed expression also help improve the shot.

## A dirty carburetor can be a real problem.



## This can be a real help.

Meet STP Carburetor Cleaner. A spray. Its needlenose can get into tough places—to help clean throttle plate, choke, linkage, and the PCV valve. The varnish and gum can actually dissolve before your eyes. STP Carburetor Cleaner. Could be what you need.

Right now. **STP**  
**Carburetor Cleaner**



# Two-way improvement



Avoid CB radio theft with magnetic mount antenna. Just lift off and lock inside vehicle. Extra-strong magnet has 90-lb. pull.



Has your CB ever let you down? Right when you needed it the most?

It could be that "good deal" antenna. Or the lightweight mike that came with the set. To get the most out of your CB, switch to Turner at both ends.

Try a Turner amplified mike. You'll find out how much talk power your set can really deliver. For full range when you need it.

Make sure your antenna is dependable. Step up to a Turner. Turner builds them tougher. There are 43 models for all kinds of base and mobile installations.

Ask anybody who has been around CB for awhile. They know us. Wherever CB is sold, Turner.

The talk of the road

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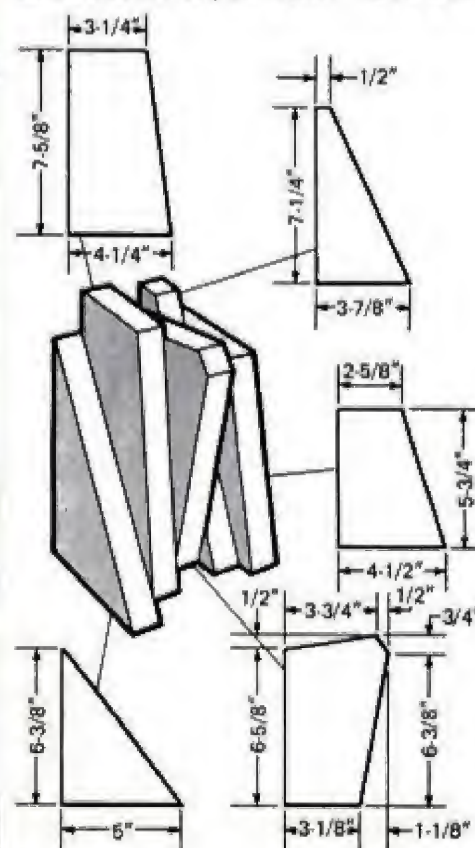
716 Oakland Road N.E., Cedar Rapids, Iowa 52402

# Sculptured bookends from scrap



If you are a scrap saver and are looking for things to make from leftovers, these "sculptured" bookends may be just the project. The pieces can be cut from one kind of wood or from contrasting woods to provide alternate layers of light and dark pieces. Cut the five parts in pairs, then sand smoothly, particularly the end-grain edges. Here a disc sander comes in handy.

Use glue only and clamp the pieces together in the order shown, keeping the bottom and rear edges even. If the pieces are hardwood, they can be stained and varnished. If pine, you can paint them. The bookends stay put from weight alone, but the bottoms can be covered with felt or sheet rubber if you wish. —Bob Tom

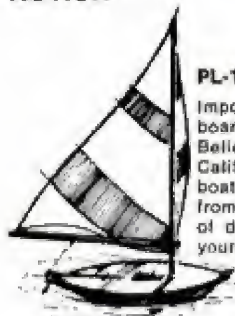




# Famous projects from PM's Plans Library

15 challenging, reader-proven projects that provide builder satisfaction *plus* something tangible from your summer of '76

## ACTION



### PL-1407 Surf Sailer

Impossible! A sailboat, paddleboard, surfboard *all* in one! Believe it or not, at Malibu, Calif., Surf Sailer is the only boat allowed to launch directly from the public beach. 75 lbs. of dynamite marine design is yours (plans, that is) for **\$9.95**

### PL-1271 Yellow Jacket

PM's hovercraft type air cushioned vehicle that you can really build and fly for under \$600. Eugene Gluhareff, designer at Sikorsky engineered this beauty so you could use readily available material. Be the envy of your town! **\$15.00**



### PL1306 The Scamp is a winner!

An 80 MPH flying Volkswagen! This VW powered biplane is sensationally inexpensive and flies like a dream. 150 mile range. Proven design. Kits and parts readily available and The Scamp is a handsome piece of work. **\$49.98**



### PL-1270 Teenie Two

Daughter of Jeanies Teenie and slicker than Mom, Teenie Two is the second generation of PM's most successful VW powered monoplane. The rage of the homebuilts, if you listen real hard you'll hear her say "Come on and fly me." **\$35.00**



### PL-1406 Boonie Bug

Starting with a junked VW bus chassis, you add some work and love and presto! A smooth riding enclosed van with ATV capabilities plus sleeping and camping facilities. Show-stopping looks too! Truly a child of the 70's. **\$14.95**



### PL-1405 Scuba-Tow

A motorcycle battery powers this streamlined fresh or salt water dream. Pulls you on or under the water for hours of effortless snorkeling or scuba diving. Rugged and dependable. Big, full scale plans and detailed instruction manual. **\$7.95**



## MODELS

### PL-1276 Quiet as a U-2!

A sophisticated model airplane powered by carbon dioxide gas. You can fly it just about anywhere because its powerplant is not much louder than the buzz of a bee. Yes, the PM BEE is our finest example of creative airplane modelmaking design encompassing classic construction with modern power. **\$3.49**



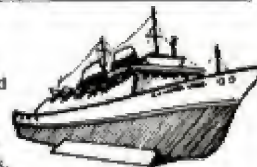
### PL-1272 Challenge of a lifetime!

The famous J.I. Case threshing machine steam tractor. 16 separate plans sheets plus instruction booklet. The finest detail work. Stacks firewood but burns alcohol. 9 separate gears in the transmission alone. What a thrill to see it huffing and puffing under its own power. **\$10.00**

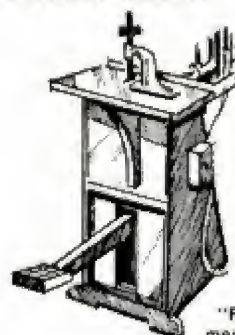


### PL-1200 SS United States

The glorious, record breaking flagship of the U.S. Merchant Marine. Though now retired in Norfolk, Va., no passenger ship has ever approached her top speed. This professional quality model is described in detail on 3 full size blueprints. Over 2 ft. long of wood and metal. A stunning project for the craftsman. **\$2.50**



## POWER TOOLS



### PL-1400 Boring Machine

Charles Kastl has designed a magnificent home-built boring machine. Horizontal, pedal operated, this tool can become the pride of your workshop and at great economy. **\$6.95**

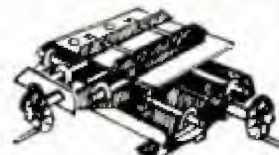
### PL-1401 Drill Press

"For pure pride of accomplishment, few things match the feeling you get when using a good tool that you built yourself." Dick Cutler should know. He designed this gem of a tool which you can build for about \$70. All parts are obtainable from hardware and hobby shops. **\$8.95**



### PL-1402 Milling Table

An ideal machine for model builders, electronic hobbyists and camera buffs. Built entirely of parts found in hardware, hobby and plumbing supply stores, this precision tool costs about \$30 to build from scratch. Another Cutler design. **\$6.95**



## BACKYARD STORAGE

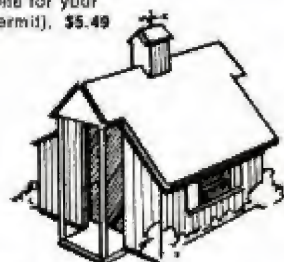
### PL-1277 Carriage House

Eye appeal, storage space and two stories! Equip it as a workshop or an office. Build the second floor as a bunkhouse that sleeps two kids. 8x12, the covered walkway widens the second floor over 2 ft. Two sets of plans (one for your building permit). **\$5.49**



### PL-1301 The Southern

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## RETURN OF THE MODEL A

(Continued from page 83)

the originals," Biebel says, "but I know darn well the roadsters we build here are a lot better than anything that ever rolled out of the River Rouge plant.

"Take certain reproduction parts, for example. There's a lot of junk on the market, most of it made quickly and cheaply overseas. It looks okay, maybe, but when you go to fit it, you find out it's not quite right, or that something that should be made of first-class material just isn't, and it breaks down easily, or it wears out overnight. You won't find any of that crap on our cars.

### Fussy work

"Also, we put 'em together on a one-on-one basis. One of us, say, does the engine every step of the way from stockpile to bench testing to final installation and run up. We don't eyeball anything. Everything is checked thoroughly. If a part is even minutely cracked, we don't bury it or rechrome it and say to hell with it. We just throw it out and start over again.

"I guarantee you," he says, jabbing an index finger for emphasis, "they weren't that fussy in Dearborn."

The thing about Biebel's fussiness, of course, is that not only does it produce superb examples of the 1931 Ford Model A roadster; it also costs money . . . and lots of it. When the roadster bowed in 1928, it cost less than \$500 in the standard version. By 1931, the base price had climbed a few dollars, but only a few. The base price of one of Biebel's beauties is \$12,500, a contrast that at first—inflation or no inflation—seems shocking. Yet Biebel swears he's cutting it as fine as he can without compromising quality.

### Cost high; value higher

"Anyone buying one of our cars gets not only the pleasure of owning and driving what I think is a nifty little car," he says, "but also a car that will appreciate in value. Hell, it's possible to build only so many of these things, and when all the original stuff is gone, that's it, there won't be any more. Right now collectors are paying a lot more than \$12,500 for mint Model A roadsters, and we're making and selling the real McCoy, brand-new, for that same money or less."

What does a buyer get for \$12,500? Well, he gets not only a Model A roadster, a car that can bring to reality a lot of fond and misty memories, but also a car that can introduce

or recall a type and style of motoring that simply doesn't exist anymore.

### Remember the rumble seat?

If you're old enough, for example, you might recall what it was like to ride in a rumble seat. If you were a young buck at the time such seats were in vogue, you might remember having an arm around a really special girl. If you were a kid then, you might remember how neat it was to ride along and wave to all your friends, a smug and beaming smile on your face. But if you were to ride in a rumble seat today, you'd be forced to remember that they could be a sauna in the summertime, an icebox in winter, and absolute agony if you were out on a chilly, rainy night.

If you have the impression the Model A was a miser on gas, you'd be surprised to discover that 20 mpg was a rarity, the usual figure being under 15, in-line Four or no in-line Four.

If you have the impression it was a lively performer, it was . . . then. By today's standards it's pokey.

Driving a Model A today will also help you appreciate modern suspension systems, not the ones that are mush, but the better ones, the ones that give you a feel of the road without cracking your teeth. Hit even a minor pothole with a Model A and your kidneys can start to ache.

If you deplore today's ventless windows and recall fondly the use of side curtains, a ride in a new Model A roadster will jog your memory: The darn things invariably leaked, and they did a lousy job of keeping out the cold.

### But oh what fun to drive!

What you might recall, or perhaps imagine, is that a Model A roadster—its top down and its delightful and simple engine beating out an altogether gratifying rhythm—was fun to drive. It was all of that, and more . . . and it still is. Driving one, it's difficult not to be swept by the realization that automobiles were once very special and unique things, plateaus of experience that defined in very personal terms and in very private ways our concepts of freedom.

Old Henry Ford was probably right to abandon the Model A when he did, but Kevin Biebel and his fellow devotees are right, too . . . there really is a lot of life left in the old girl, and a small army of us would give our eyeteeth to have one of our very own. ★★★





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## SUPER THRILL RIDES

(Continued from page 81)

95-foot-high tower. At the Six Flags Over Georgia amusement park in Atlanta, the "Great American Scream Machine" carries occupants up a dizzying 105-foot-high tower before plunging them down a near-vertical drop. At Busch Gardens in Williamsburg, Va., a simulated bobsled run puts passengers through 2800 feet of twisting, turning, rolling track to give them the feel of a real bobsled ride.

For sheer size, the monstrous "Screamin' Eagle" run at Six Flags Over Mid-America in Eureka, Mo., takes the prize as the world's longest, tallest, fastest roller coaster. The 3872-foot ride carries passengers to an incredible height of 110 feet and hurtles down steep, 92-foot-long dips and dives at speeds of 62 mph. The \$3-million structure consumed 550,000 board feet of lumber, 65,000 pounds of bolts and nails, 10,000 gallons of paint and 130,000 man-hours of labor.

### Pulling Gs like a pilot

Coming in a close second is "The Great American Revolution" at Magic Mountain park in Valencia, Calif., billed as the longest, highest all-steel roller coaster (the Screamin' Eagle is bigger but made of wood). Incorporating a 90-foot-high, 45-foot-diameter vertical loop, the ride covers 3657 feet of steep, twisting, spiraling track at speeds of 50 mph. Entering the loop, riders experience a phenomenal 4.94 G force—as much as many stunt pilots pull.

For a bit of nostalgia, the "Texas Cyclone" at Astroworld in Houston will be of more conventional design, but will still give patrons all the thrills and scares of top roller-coaster riding. With 3180 feet of track and 53° drops, it will be a Texas-size version of New York's famous Coney Island Cyclone built in 1927.

Why put yourself through all this torture—and pay for it besides? It's a way of conquering fear, says Chaytor Mason, associate professor of Human Factors-Psychology at the University of Southern California. "A thrill ride permits one to test himself. You experience a sensation, realize it's not so bad and achieve the satisfaction of knowing you gained control over yourself."

Screaming is socially acceptable, adds the professor, himself an aerobic pilot. "A scream is a release of a fear response, but on a roller coaster it's all right—you can let off pent-up energy." A lot of thrill riders yell their heads off—loving it all the way. ★ ★ ★

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## DISTRIBUTOR TUNE-UP

(Continued from page 113)

distributor shaft, twist the shaft about 5° in the direction of rotation, and let go. Action should be snappy.

The direction of rotation can be determined by having someone crank the engine for a second or two as you watch in which direction the rotor turns.

**10. The spark advance mechanism** should be tested to get an idea if it's working. The unit is a vacuum-operated chamber which is usually attached to the outside of the distributor (Fig. 5). It controls ignition timing during acceleration, causing spark to occur earlier.

Place your finger against the rear of the distributor breaker point assembly, pressing against the assembly in a direction which is opposite that of shaft rotation. This causes the distributor point base plate (breaker plate) to turn.

Release the point assembly. The breaker plate should swivel smartly back to its original position. If it doesn't, the cause of the bind (weak spark advance unit or damage to the distributor itself) should be found.

**11. Remove the breaker points** from the distributor for examination. It is difficult in most cases to get a good look at the points with them still in the distributor.

Loosen the terminal screw on the breaker point assembly and remove the coil-to-distributor primary wire. At this point, let's stop a minute and give that primary wire a very close examination, especially where it enters the distributor housing (Fig. 6). You may spot a potential problem which, when it occurs, baffles car owners and mechanics alike.

A reason for sudden ignition failure, leading to stalling when the car is on the road, is worn primary wire insulation. Exposed bare wires short themselves against the metal distributor housing, which interrupts the flow of current.

Replace a badly frayed coil-to-distributor primary wire.

Also disconnect the condenser pigtail wire between the condenser and breaker points. If this wire is damaged, replace the condenser.

**12. There is no need to install new distributor points** unless they are needed (Fig. 7). Spread the two points apart and examine surfaces. If points have an overall gray color and/or show slight roughness or pitting, pass a clean fine-cut contact point file between them two or three times. Wipe point surfaces with a clean lint-free rag which has been moistened with alcohol.

**Cautions:** Do not try to file points

smooth. The purpose of filing is to remove scale and dirt. Be sure the file is neither greasy nor dirty since contaminants will be passed on to point surfaces. And don't use emery cloth or sandpaper for cleaning points. Particles will embed themselves, causing arcing and rapid deterioration of point surfaces.

**13. If distributor points** are severely burned or very rough, replace them with a new set. However, there is usually a reason why points get this way if they have failed within, say, 10,000 miles. Unless the condition is found and corrected, new points may also fail prematurely.

The usual causes for rapid point failure include a weak condenser, weak contact point spring tension, improper point gapping, an over-lubricated distributor cam that is tossing lubricant onto point surfaces, malfunctioning voltage regulator, bad resistor, and oil or crankcase vapors that are seeping into the distributor housing and affecting points.

**14. If you have to replace contact points**, replace the condenser, too. The two work as a team. Unscrew the condenser mounting screw and lift the part out of the distributor (Fig. 7).

**15. Wipe the breaker plate clean.**

**16. Lubricate the cam.** Some distributors are equipped with a cam lubricator wick that you should replace with a new one (Fig. 8). Do not relubricate an old wick. You'll cause more trouble than a new one is worth.

Distributors that don't have wick lubricators should have one drop of distributor cam lubricant applied to one lobe of the cam (Fig. 9). The drop of lubricant should be equivalent in size to the head of a match.

**17. Place the condenser** into position on the breaker plate and tighten its mounting screw.

**18. Install the breaker point assembly**, screwing it securely to the breaker plate.

**19. Now, reconnect the primary ignition** and condenser pigtail wires, but make very certain that the terminal clips aren't in contact with the breaker plate. This will cause a short. Tuck the two wires carefully into the housing, but see to it that they aren't touching any moving parts (Fig. 10).

**20. Gap points**, using a distributor point (flat) feeler gauge. The purpose of gapping is to bring point adjustment inside the ball park. When the distributor is reassembled and buttoned up, points should be finely adjusted by means of a dwell meter.

To gap points, set the rubbing block of the breaker point assembly

(Please turn to page 158)





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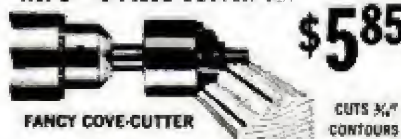
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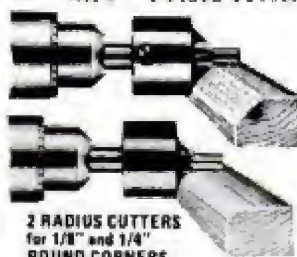


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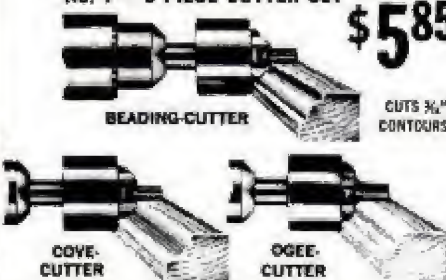


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## DISTRIBUTOR TUNE-UP

(Continued from page 156)

on a lobe (raised part) of the cam. You may have to tease the cam into place by having someone in the car crank the ignition in short spurts until the rubbing block ends up resting on a high point of the cam.

You might want to consider the purchase of a remote starter switch, which allows you to crank the engine from beneath the hood. It's a handy device to have around, especially if there's no one available to give you a hand.

In order to gap points, you will need the specification for your distributor. This may be obtained from a tune-up decal which may be pasted somewhere in the engine compartment. You can also get the spec from a service manual or owner's manual.

The gap specification is generally given as a range—for example, .016-.019 inch. If points are new, gap them to the maximum specification (.019 inch). If points are used, gap them to the minimum specification (.016 inch).

Use a feeler gauge that's the same thickness as the specified point gap setting (.016 inch, for instance). Insert the gauge between the points.

**Caution:** Make sure the feeler gauge is absolutely clean. Hold the gauge straight. Don't twist it. The measurement will not be accurate if you do (Fig. 11).

If you don't feel slight resistance on the gauge as you slide it back and forth between points (if the gauge moves too loosely or rubs hard), points have to be adjusted in one of two ways. One way is by means of an adjustment notch in the point assembly, near a mounting screw. Loosen this screw, insert a screwdriver in the notch, and twist until points open or close to the desired setting (Fig. 12). Keep the gauge in position, testing until the proper gap is attained. Then tighten the mounting screw and doublecheck to make certain the gap is as specified. You can also use a point adjustment screw. Insert an Allen wrench in the screw head and turn the screw until the desired setting is attained. Keep the feeler gauge in place, testing as you go along.

21. Finish distributor tune-up by installing the RFI shield, if one is used, and rotor. If the rotor is the type that fits on the distributor shaft without being held by screws, apply two or three drops of SAE 10 or 20 engine oil directly to the inside of the shaft. Make certain no oil drips into the carburetor housing.

Reinstall the distributor cap se-

(Please turn to page 160)



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### DISTRIBUTOR TUNE-UP

(Continued from page 158)

curely and replace cables. Be certain that each cable is inserted into its proper tower.

To seat cables properly, squeeze cable boots as you insert the terminal into the tower to release trapped air (Fig. 13). Make sure cables are firmly seated. If they aren't, arcing may occur, damaging the distributor cap and terminals. ★★

### OLD CARS NEVER DIE

(Continued from page 85)

coupe based on the 1968 Plymouth Belvedere body dies and mechanicals.

The Polara (Dart) comes with the 225-c.i.d. Slant Six at 145 bhp, boosted to 155 in the Polara RT coupe. The RT has a four-speed manual gearbox as standard equipment.

The GTX coupe (Belvedere) uses the 318-c.i.d. V8, rated at 230 bhp (all ratings are SAE gross), four-speed on the console, reclining buckets and iodine headlamps. All Argentine Dodges have front disc brakes.

### Spanish Dodge

In Spain, too, Chrysler Corp. markets what it calls the Dodge 3700. Americans will recognize this car as basically the 1969 Plymouth Satellite sedan with slight sheet-metal changes: full rear-wheel cutouts, a different grille and taillights, plus instrument panel variations.

The Dodge 3700 gets its model designation from its engine displacement—3687 cc. This is again the 225-inch Slant Six, this time rated at 165 bhp. The car uses a three-speed transmission as standard equipment, with a four-speed manual optional.

There's a GT version of the Dodge 3700 in which the four-speed is standard, as are front bucket seats, console and upgraded trim. Only one body style is offered—the four-door sedan. Power steering plus front disc brakes are standard on all versions.

### Spanish AMC Jeepster

Ever wonder what happened to the Kaiser (AMC) Jeepster of 1967-73? It's retired and still being made in Spain, nearly identical to the 1972-73 version (104-inch wheelbase).

Available as a full convertible, a pickup with removable hardtop, and as a two-door station wagon, the Spanish Jeepster's basic engine is the AMC 232-c.i.d. pushrod Six. This engine delivers 145 bhp and couples with a three-speed manual, floorshift gearbox. The car comes with two or four-wheel drive. ★★



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## Let'em roll!

## LONGEST TUNNEL

(Continued from page 76)

perilous. The ferry trips take a grueling 4½ hours and are suspended an average of 80 times a year because of hazardous conditions.

The Seikan Tunnel will change all this. It will extend Japan's already famous high-speed rail system under the Straits from Honshu to Hokkaido, providing a direct, permanent, year-round, all-weather connection. Fast, modern bullet trains will whisk residents of Tokyo to beautiful Sapporo, site of the 1972 Winter Olympics, in five hours and 40 minutes compared to the current 16 hours and 30 minutes—saving nearly 11 hours.

With locomotive cabs at both ends, the electric-powered, streamlined trains will be able to shuttle back and forth without having to turn around or change engines. They will operate on dual tracks, permitting simultaneous two-way service.

### No easy task

Building the tunnel has not been an easy task. Surveys for the route were begun as far back as 1946, with exploratory excavation started in 1964. At the present rate of progress (the tunnel is about half completed), construction is not expected to be finished until at least 1982. Thus, from planning to execution, the monumental project will have spanned more than 35 years before the first train roars through—evidence of the enormous difficulties involved.

A bridge would have been much easier and cheaper to build, but the deep waters, swift currents and vicious storms of the Tsugaru Straits

ruled out this possibility. It became necessary to go underground—and that brought its own problems. The water depth of the Straits at midpoint is almost 460 feet. For structural safety, the tunnel must burrow another 328 feet under the seabed—or a total of 788 feet below sea level.

Because of its great depth, the Seikan Tunnel must be much longer than shallow river tunnels or straight-through mountain tunnels. To maintain a reasonably gentle slope of 12° and avoid towering coastal mountain ranges on both sides, it was necessary to start the tunnel entrances many miles inland from the shorelines. That's why the tunnel's overall length is more than 33 miles even though its undersea portion is less than half that. And the longer you make a tunnel, the more complex it becomes. Problems of ventilation, power supply, lighting, equipment maintenance, fire prevention, emergency evacuation and so on multiply to a staggering degree.

### Tricky engineering

With mountain tunnels, such as those in the Alps and Rockies, you can bore vertical access shafts down from above along the route to simplify construction, maintenance and ventilation. But with an undersea tunnel there's no way to bore such shafts down through water. For this reason, the Seikan is not a single tunnel, but is actually an intricate maze of multiple tunnels, some paralleling the main tunnel, some spreading out in different directions.

These supplementary tunnels serve the purpose of access shafts, provid-

(Please turn to page 164)



Pilot tunnel, nearly complete, shows two rail tracks, complex array of power cables and ventilation ducts. But appearance is crude compared to how finished tunnel will look.



# Vivitar TX Lens System

## The ultimate in lens interchangeability.

One of the most useful features of 35mm SLR cameras is their ability to photograph through an incredible variety of "interchangeable" lenses—from wide angle to super-telephoto.

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In most cases, one manufacturer's lenses aren't interchangeable with another manufacturer's camera. So changing cameras means making another big investment in accessory lenses and taking a beating on your old ones.

Vivitar's TX lenses eliminate that problem by being interchangeable with just about all the popular 35mm SLR cameras now on the market. Thanks to an ingenious adapter system, any TX lens will work on many different cameras. So if you change cameras, you keep the lenses and all you have to buy are the inexpensive adapters for your new camera. Each TX lens and adapter couples to the through-the-lens exposure system of the camera (including automatic exposure control models) just like the manufacturer's own lenses.

All TX lenses are the result of computer-generated optical designs. Each one

is a superior performer, lightweight, compact, multicoated, and among the fastest in its respective focal length. Wide angle lenses — 24mm f2.8,

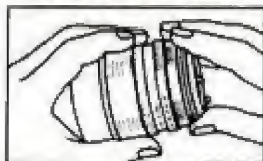
28mm f2.5, 35mm f2.5. Telephoto lenses — 135mm f2.5, 200mm f3.5, 300mm f5.6, 400mm f5.6. Zoom lenses — 75 to 260mm f4.5, 90 to 230mm f4.5.

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3. Rotate the lens mount locking ring to lock the adapter on the lens, then mount the lens to your camera in the usual way.



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## LONGEST TUNNEL

(Continued from page 182)

ing a means of getting to the main tunnel for maintenance work or emergency aid. Some tunnels also slope downward for draining off water that may seep in. Galleries—large, cavern-like extensions—fan out at intervals of 2000 feet and are used to inspect geological conditions and water-seepage problems.

To complicate matters, there are at least 10 geological faults fracturing the seabed along the tunnel's path, and volcanic rock on the Honshu side is riddled with numerous deep fissures. Heavy water seepage is expected at all of the faults and fissures.

### Slow going

Huge drilling machines chew away at the undersea rock at the rate of 6½ feet an hour—fast compared to old-fashioned hand-digging methods, but still a time-consuming operation considering the tremendous distances and complex engineering involved. Unlike mountain tunnels, which can be built in relatively short, straight sections, the long, winding Seikan must be constructed by boring from both ends toward the center, with elaborate electronic guidance sys-

tems to assure that the two ends meet precisely at the midpoint—under nearly a sixth of a mile of seawater and bedrock. So far, a pilot tunnel has been driven through successfully, but the main two-track rail line has advanced only a few miles under the forbidding Straits.

As the drilling machines pierce the water-laden rock, the walls of the main tunnel are sprayed with a 2½-foot-thick lining of concrete. Where water seepage exists, the surrounding rock must first be sealed with a waterproofing chemical grout injected into existing fissures and predrilled holes. Heavy steel H-beams are installed for added reinforcement at unstable sections or where severe seafloor pressures may impose dangerous stresses on the tunnel walls.

### A tunnel with no equal

The Seikan project is under the supervision of Japanese National Railways, with the Japanese Railway Construction Public Corp. as the general contractor. Like many other major construction jobs in the world, the tunnel has been plagued by problems of recession, inflationary cost overruns and technological delays. Its cost, first pegged at about \$500

million, is now expected to exceed \$1 billion—more than double the original estimate. When completed, however, it is likely to have no rivals.

How will the Seikan stack up against other record-holders? The longest current road tunnel—a little more than seven miles—runs through Mount Blanc in the Alps. The longest rail tunnel now in use is the Simplon, a 12½-mile underground link between Italy and Switzerland that, incidentally, cost the lives of 60 workers. The Chesapeake Bay Bridge-Tunnel system spans 17.6 miles, but the longest underwater tunnel section is just over a mile.

The only potential challenger is the long-planned, much-discussed, highly controversial and now apparently abandoned "Chunnel" linking France and Great Britain under the English Channel (see *Is the Chunnel for Real?*, page 90, Jan. '75). If this undersea link is ever built, it could conceivably top Seikan's length by a mile or two (estimates of possible Chunnel length vary from 31 to 35.6 miles). However, it now seems unlikely that the Chunnel will come to pass, at least not in the near future. So it looks as if the Seikan Tunnel will reign supreme in the record books for a long, long time. ★★★

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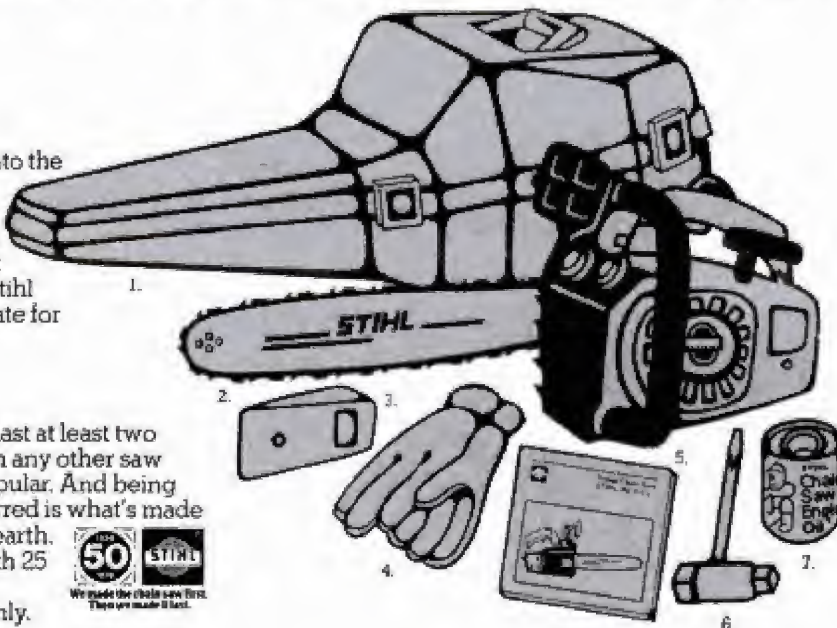
This Christmas we'd like to put a little Stihl into the hands of everyone. And to do it, your Christmas spirited Stihl dealer will give you 25 dollars worth of the free extras shown below just for buying our tough, little 015L Chain Saw. But hurry. We can't keep this big deal on a little Stihl going long. And at 25 dollars a crack, we'd hate for you to lose out simply because we sold out.

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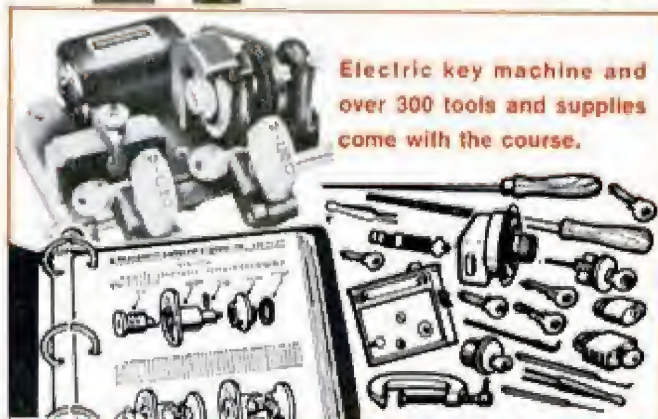


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## MOTORCYCLING

(Continued from page 91)

six-foot-two pilot. So much for the Can-Am in particular. It opened up a new motorcycle world to an ex-Indian Shaftly veteran.

For me, two years on an enduro have taken the terror out of loose gravel. Wet leaves keep you alert, but they don't put you down. The chuckholes you once detoured are now fun bumps to hit and jump out of. And detours, the kind with torn-up tundra and water truck slick clay and fresh round gravel—those become an opportunity to pass a whole line of fat station wagons and a few superbikes tiptoeing along, afraid they will scratch their chrome.

### Tires in the rain

Most enduro bikes come with a tread called "trials" or "trials universal." They hold on gravel, stick to railroad tracks, float through sand, and will find any traction that is to be found on wet leaves, grass and gutter garbage. They are not as knobby as motocross rear rubber on the highway, and that can be dicey on a rain-slick highway. Look for a tread pattern which is siped, not too "knobby," and puts more rubber on the road. Make sure they are very "round" to take full advantage of the high clearance and low cornering of enduro designs. Then you can lean till the spring-back pegs spring, or your boots wear bald, whichever comes first.

### No passengers

Enduros don't come with passenger pegs, and don't add them. These machines are not designed for two-up riding. The suspension is tuned to take one person over and through almost anything safely. A passenger ruins the ride, and extends passing and stopping distances too much for safety. A hundred and seventy-five cubes can only move so much meat, even on a 25-horse Can-Am.

Quarter-ton multi-piston monsters have their place. Long-distance touring, riding double, road-eating weekends covering several hundred miles, and the pure pleasure of high speed behind a wind-shedding and bug-catching fiberglass fairing—this is a great part of motorcycling. But not the only part.

To go to work, get the mail, carry the groceries, and chase a fish on Saturday, look again at the enduros. Not the 125s. A bit skinny in freeway competition. Not the 250 cc or 400 mudthrowers unless you really want to race enduros and do a complete teardown and rebuild after each race. Try a good 175. ★★





# THE WORKMATE,<sup>TM</sup> THE CIRCULAR SAW, THE DRILL AND THE JIG SAW (or how Black & Decker built the barn).

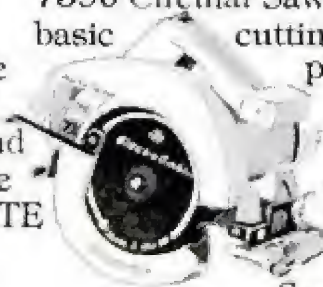
If you were to start out with a pile of boards, beams, and a keg or two of nails (plus a little knowledge and a lot of energy), you could build a barn.



Of course, you'd need something to hold, cut, trim and drill the wood. And that's where Black & Decker comes in.

You'd start off with the WORKMATE—the incredible portable workbench made of sturdy, die-cast aluminum and steel with a wood-ply top. The WORKMATE can hold just about anything from a 2x4 to a barn

door. Its vise jaws work independently, so no matter how varied the shape, the WORKMATE can hold it. Up to 350 pounds' worth. And it folds for easy carrying or storage. And while the WORKMATE does the holding, the Black & Decker 7390 Circular Saw does the basic cutting with its



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## SNOWMOBILE

(Continued from page 102)

add warm spots in a cold sleeping bag.

### Camping gear

If you plan to camp out (or suspect that you might have to), take along a light backpacking tent, snow saw and snow tent pegs (though one side you can tie to your snowmobile), winter-loft sleeping bag, and all your regular compact camping equipment. All, that is, except your butane stove which dislikes operating below freezing. Stoves which can be pumped up will usually work satisfactorily, but test them first at home. Be sure your cooking kit has a pot for melting the snow to make the water necessary for reconstituting the handy new freeze-dried food. If there is sled room for an ice chest, it can help hold heat and keep a canteen of warm water from quickly freezing. Food, cameras and clothing can be stored without fine snow dusting in.

### Emergency gear

Emergency gear—those items that you hope you'll never use—had better be top-quality. Often, like flashlights, they may get continual use so

be sure they always have fresh batteries. String, wire, rope and the strong nylon line called parachute cord will all come in handy for both normal touring and emergency use. Signal mirror, bandages and splints, strobe light, flares, compass, whistle, wire saw and citizens band transceiver are simple items, yet each could help save a life. Photographer Elder also squirrels away small metal coughdrop boxes with niceties like thread, tweezers, can opener, nails, razor blade, toothpicks, scissors, pins, pencil, dot rivets and tag wire.

Candles may be among the most important of extras to have along. They make fire-starting simple, provide light, warmth, and even heat for cooking and melting snow for water, especially when several are used together. Long-lasting stearic acid types with less tendency to melt over gear when warm are available from camping equipment stores.

Avalanches can be a danger almost any time of year above the snow line. Long cords, some with colored markings (to show how deep you are buried) can be dragged behind your machine, and Company 3, in Aspen, Colo., offers a \$60 Avalanche Pieps which transmits a locating signal to a radio receiver.

Snowmobilers in avalanche country should make a study of likely conditions and note the paths of previous slides and the trees and outcroppings that may afford protection.

Several years ago during a winter snowmobile camping trip with Ralph Plaisted, the famous Minnesotan who reached the North Pole on his Ski-Doo, he pointed out the special advantages of the snowmo safari. While gear should not be so heavy it bogs down your machine, it still can be durably made and strong enough, Ralph discovered, to weather days of Arctic storms. Tents of the Plaisted party were anchored to the machines during blizzards. Large camping stoves, plentiful food and sufficient fuel could all be towed on their sleds so the adventurers were not completely dependent on aerial supply drops. Even a driver out for only an afternoon run can easily pack enough of today's compact survival supplies to take the most unexpected hazards out of the sport.

Unlike a backpacker, the snowmo driver doesn't have to get by with minimum gear—he has the space, facilities and power for carrying all his needs. This year there is abundant equipment to make the sport even more fun—and safer. ★★

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Beryllium	X	X			X
Carbon	X	X		X	X
Cast Iron	X	X			X
Composites	X	X	X		X
Composition Board			X	X	X
Fiberglass	X	X	X	X	X
Foamed Glass	X	X			X
Friction Materials	X	X	X	X	X
Glass	X	X			X
Hardened Steel	X	X			X
Honeycomb Materials					X
Marble, Natural	X	X	X		X
Marble, Synthetic	X	X	X	X	X
Plaster			X	X	
Plastic Laminates	X	X	X	X	X
Plywood			X	X	X
Stainless Steel	X	X	X		X
Stranded Cable	X	X			X
Superalloys, Iron-base	X	X			X
Superalloys, Nickel-base	X	X			X
Tempered Hardboard			X	X	X
Tires, Steel-reinforced					X
Titanium	X	X			X
Tile, Ceramic	X	X	X		X

\*Requires coolant and variable-speed machine



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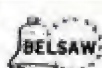
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# Big-rig wranglers show their tender touch

At the national truck 'rodeo' it's not calf-roping and bulldogging. But the competitive strain at the safe driving championship is just as grueling.

by Bill Kilpatrick

**T**he next time you duck into a truck-stop for a quick cup of coffee and notice one of the drivers sporting a distinctive gold or silver belt buckle proclaiming him to be a "rodeo" champion, pay attention. That man is something special.

He may look like the guy next door, but in the world of trucking he's a man capable of passing the proverbial camel through the eye of the proverbial needle. In being designated a rodeo champion, he has demonstrated an ability to perform certain delicate maneuvers with trucks ranging in size from big to mammoth—maneuvers you might have trouble performing behind the wheel of the family car.

He can, for example, parallel-park a big semitrailer in a space only four feet longer than his rig. He can tuck it in so close, his curb-side rear wheels are within six inches of the curb. He can do it without touching, however gently, the curb or any vehicles or barriers limiting the width of the parking

space. And he can perform this wizardry making only one pull-up getting in, only one getting out.

As another example of his rodeo skills, he can—using only his side-mounted left and right rear-view mirrors—back his rig up in a straight line along a narrow "alley" to within six inches of a simulated loading dock. If he so much as barely touches the dock, it's a wipe-out. If he stops more than six inches from the docks, he is penalized points. Stopping over 18 inches from the dock is another wipe-out.

## Tricky driving

If you want more evidence of his special status among his fellow truckers, consider that he can, if all goes well, guide his truck through a narrow double row of small rubber balls balanced precariously on tees, with only a two-inch clearance on either side of his right—or offside—wheels. To bring this one off successfully, he has to line up his

(Please turn to page 172)



**A tough parking problem** (top) forces a driver to maneuver a big rig to within inches of the curb (middle). All the contestants line up (bottom) before the competition to be introduced to the audience.



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## BIG-RIG WRANGLERS

(Continued from page 170)

single right front tire (again, the offside wheel) dead center in the row of rubber balls so that his trailing double-tire tractor and van wheels do not topple any of them off their tees.

Like the man said, try *that* on your old piano some time.

Rodeo drivers compete each year, first in statewide, then in national championship drive-offs to determine winners in seven classes of trucks ranging from conventional two-axle units to huge and tricky twin-trailer rigs. They are, to put a cap on it, the cream of the nation's truck-driving crop.

### The pros' high point

This year's crop of state champions displayed their skills in Texas at the American Trucking Assn.'s (ATA) 36th annual National Truck Rodeo held at Fort Worth's Tarrant County Convention Center. Over 200 drivers representing 37 states competed, with winners being crowned in seven different categories. On hand for the three-day event was a small army of ATA officials and about 2000 spectators, most of whom were families and friends of the drivers. To the competitors, the annual national Rodeo represents the high point of their professional lives; to them, it's the equivalent of baseball's World Series.

To be eligible to compete in a Rodeo, a driver has to be a full-time pro, must have an accident-free record for at least one year, must be in good all-round health, and must have been employed for at least a year by a licensed motor freight carrier. Independents (owner/operators) are *not* eligible to compete

unless they operate regularly and exclusively for a single licensed carrier and have done so for at least a year prior to entering a Rodeo.

### One out of seven

Drivers compete in one of seven classes of trucks—straight truck; three, four or five-axle semi-trailer; flatbed trailer; tank trailer; twin-trailer. Drivers can compete in one class only, regardless of how skilled they might be in handling other types of rigs.

In addition to the actual field-test driving, competitors must submit to three nondriving tests.

The first evaluates a driver's appearance and personality. It is the only purely subjective test the would-be Rodeo contestant undergoes and it counts for a maximum of 60 of a theoretically perfect overall score of 500. It is not uncommon for the ATA official conducting the test to deliberately antagonize a driver to determine how well he reacts to pressure, and more than one driver thus needled has wobbled out of the interview a shaken man.

The contestant then takes a series of four written exams, each of which rewards a maximum of 20 points. Drivers are tested on safe-driving rules and regulations, on first-aid, on proper firefighting procedures, and on their knowledge of the trucking industry in general.

### Find the trouble

The final nondriving test is a pre-trip inspection of the vehicle they are about to drive in the field test. ATA Rodeo officials plant varying numbers of defects in nearly 80 items

(Please turn to page 174)

Driving down a marked line without bumping precariously mounted balls is very hard.





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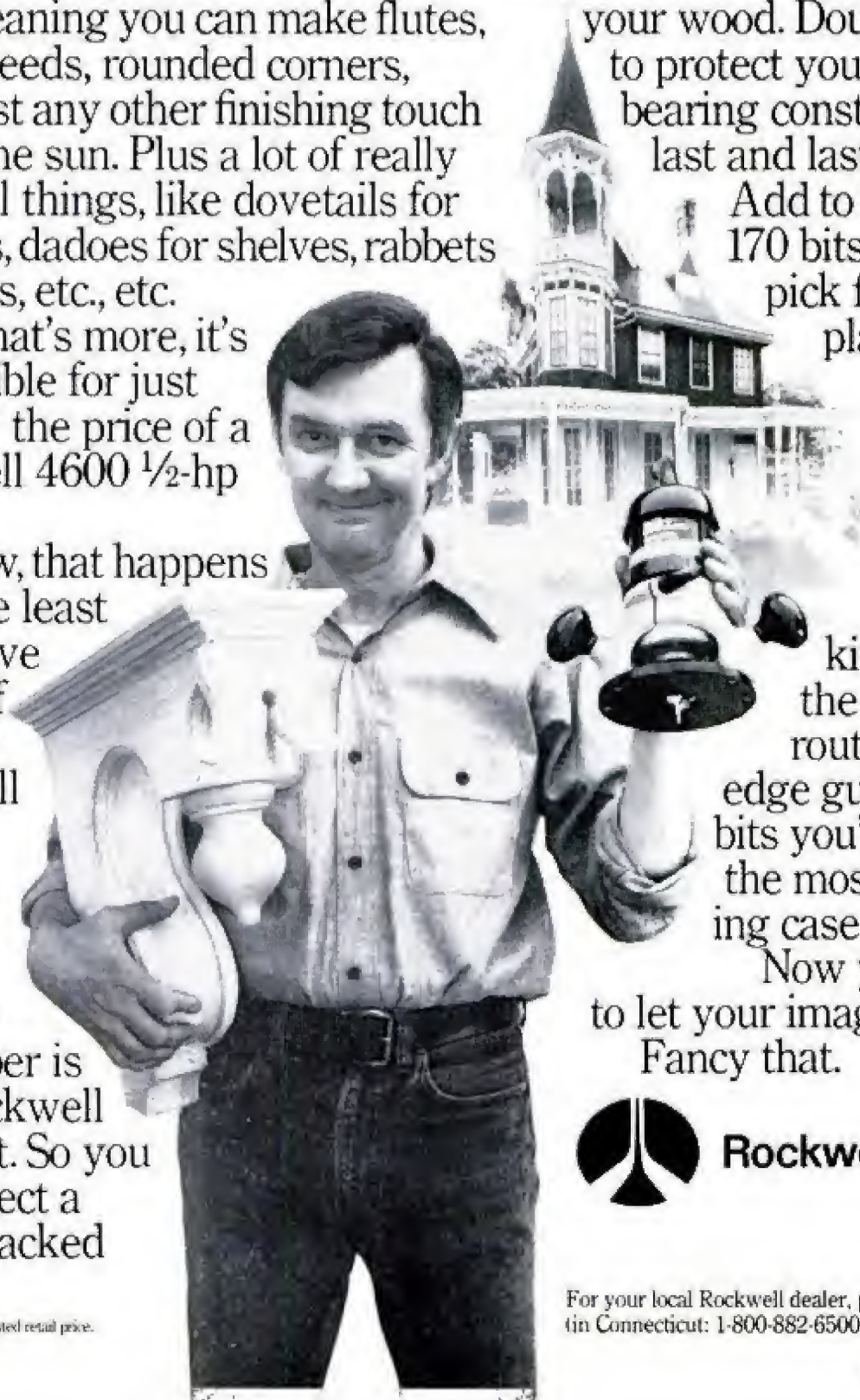
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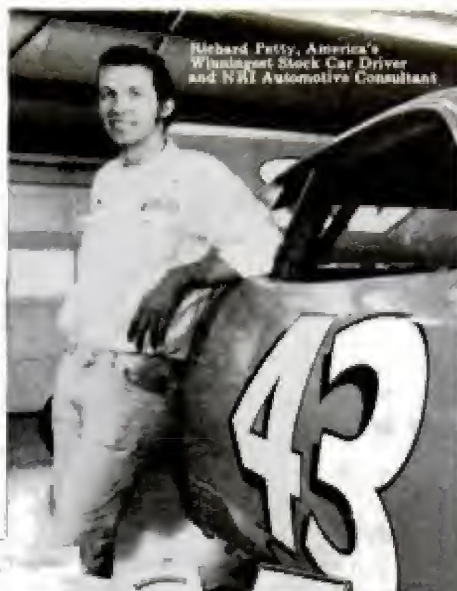
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## BIG-RIG WRANGLERS

(Continued from page 172)

that must be checked before a driver takes off. Typically planted defects might include an uncharged fire extinguisher, an air-hose leak, a missing windshield wiper blade, faulty headlights, a gate valve that's open instead of shut, and so on. The test can result in a maximum of 60 points, and drivers are graded not only on their ability to spot the defects, but also on their overall inspection efficiency.

All vehicles used in a Rodeo (most provided by local dealers are brand-new and as individual units have never before been seen by the drivers. Contestants cannot, in other words, compete in the trucks they regularly drive on the job. They do have a choice of available equipment, but if a driver happens to be, say, a Peterbilt man, and there isn't a Peterbilt on hand, it's too bad, period. He just has to make-do.

## Everyday problems

Depending on the type of equipment being driven, the driving test consists of six problems designed to simulate typical situations a driver encounters in the course of a working day. Each of the problems is valued at 50 points, so the driver who manages to complete the course perfectly gets 300 points. However, such a score is rare.

Drivers have to complete the indoor course without striking a barricade, running over a boundary line, ticking one of the earlier-mentioned rubber balls, or making an unauthorized stop. Anything less than absolutely perfect execution results in penalty points of varying amounts.

In addition to "solving" the "problems," drivers must complete the course within a certain time limit, usually 8 or 10 minutes. They get no plus points for being under the limit, but are subject to penalties if they fail to get around on time.

## Driving tests

Typical driving test problems include the parallel parking, alley dock backing, and straight-line control mentioned earlier, plus snaking around barrels and barricades, making a right-hand turn without running over a simulated curb (the more delicate a driver's touch, and the closer he comes to the curb without hitting it, the more points he scores), and coming to a complete stop at a fixed line (the closer his unseen bumper is to the line, the higher his score). Before the actual drive-off begins, competitors in each

(Please turn to page 176)



# Maintenance-free batteries:



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On the left is Gulf's new Cruisemaster-MF, maintenance-free battery. Notice the vent caps. On the right is a "sealed" maintenance-free battery. No vent caps! During normal battery life, neither kind needs water. But emergencies can happen. Then what?

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Cruisemaster-MF generally costs less than most other MF batteries. Yet performance is the same. Of course, as with all batteries, occasional cleaning of terminal posts or recharging may be necessary.

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See the complete line of Cruisemaster-MF batteries at your Gulf station or Gulf Tire Store. Pick the power right for your car. We think you'll agree you made a wise move.



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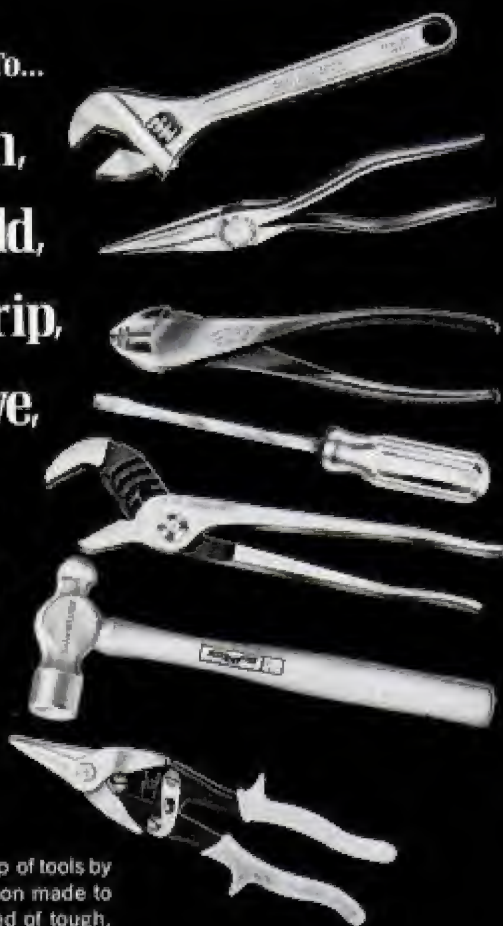
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**BIG-RIG WRANGLERS**

(Continued from page 174)

drive-off begins, competitors in each class are allowed to walk—en masse. Just about all drivers run the course in second gear of the low range.

**The sweats**

Classifying the competition as intense states the case far too mildly. Any number of drivers at this year's nationals, most of whom are old hands at such events, could be observed enduring various degrees of the nervous sweats as their turns to battle the intricate course ap-



Checking out the rig before driving is all part of the competition's requirements.

proached. At stake is not only peer recognition and a certain prestige throughout the trucking industry, but also appropriate trophies and plaques and plain old coarse, green money—\$1000 to class winners, \$500 to runners-up. Few drivers, however, admit the prize money is what brings them out.

"Oh, it's nice, of course," said Gerald LeJeune, of Eunice, La., a tank truck driver for Enterprise Products Co. and a Louisiana state champion. "Hell, I can always use the money. But it's not the main thing. I want to win because it represents the top of the heap in my profession."

But Gerald LeJeune didn't win. The nation's best truck driver this year is George P. Holik from Oak Lawn, Ill. He's an 18-year career man with the Eazor Express of Chicago and has driven 700,000 continuous miles without an accident.

**'Moment in the sun'**

For just about all the drivers a Rodeo is their "moment in the sun." Each contestant, before he drives the course, is introduced over the public address system. Given is his

(Please turn to page 183)

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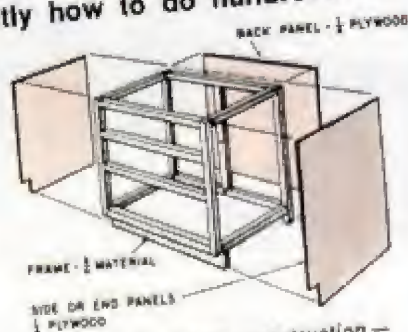
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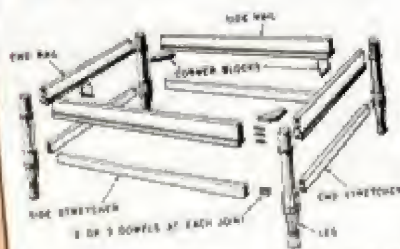
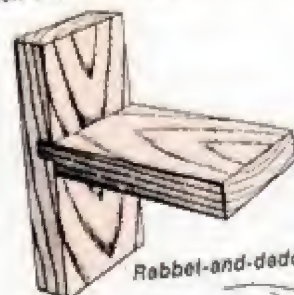
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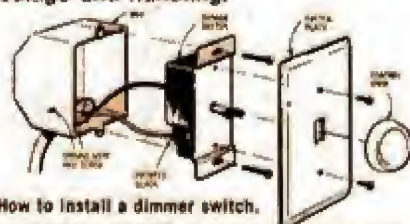
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## BIG-RIG WRANGLERS

(Continued from page 176)

name, age, home town, his wife's name, the names, ages and sex of his children, the name of his employer, his safety record and—if any—past Rodeo record, his military service affiliation, any fraternal or civic associations to which he belongs, his church affiliation, and mention of his role in any community service projects.

In that most of us live our entire lives in anonymity, this sort of public recognition is pleasantly heady stuff. And the men respond accordingly. As part of the ceremonies preceding the start of the drive-off finals, the men—each of whom is a state champion—are lined up in front of the crowd and introduced individually.

The appearance of most drivers at a state or national Rodeo is sponsored by the trucking firms for which they work. Indicative of the prestige accruing to both driver and employer as a result of qualifying for Rodeo competition (to say nothing of winning), most sponsoring firms pick up all tabs—transportation, rooms, meals, and so on—for a competitor and his entire family.

Many families turn out in identical uniforms—even the youngsters—bearing their individual names and the names of the companies for which the men work.

### Not all sweetness

However, despite the family and fraternal "togetherness" discernible at such an event, a Rodeo is not necessarily all sweetness and light. Because the competition is so intense, the overall mood at this year's nationals, for example, was somewhat somber. The crowd watching it had little response to offer drivers other than those in which certain of its segments were interested and squeezing for. An error-free run usually resulted in general applause, but it was desultory on the part of all but a given driver's highly partisan fans.

Partisan fans, in fact, represent a potential problem to ATA officials conducting a Rodeo. The shouting of advice to contestants—such as "Too far right!" or "Straighten it out!"—is prohibited, but in the heat of the scuffle, fans can easily get carried away. Officials also monitor

the crowd for partisan-inspired signals—a program waved a certain way, a flaring cigaret lighter that might signal when to stop, and so on. As the events gain in significance and prestige, official surveillance is hard-pressed to run neck-and-neck with partisan ingenuity.

Still, in spite of the occasional and admittedly mild hanky-panky that might show up at a Rodeo, the event in general has a pleasing "down home" quality that is in many ways reassuring. To most of us, trucks are a blunt fact with which we have to contend out on the road (their drivers feel the same way about us, incidentally), but when the industry gathers each year for its big Rodeo, the demeanor it displays is sunny, concerned, and very much Straight Arrow.

At Fort Worth this year, for example, faces were scrubbed and smiling, and, as a prelude to the finals, hands were placed over hearts as *The Star Spangled Banner* was played over the public address system. You don't see that sort of thing much anymore . . . and seeing it is kinda nice. ★★★

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# How new FM tuner specs can help you buy the right hi-fi components

By Ivan Berger ELECTRONICS EDITOR

**B**uy an FM tuner or receiver, and you're not so much buying a hi-fi component as a batch of specifications that are supposed to tell you how the component will perform. The trouble is, the specifications have been out of date since shortly after they were introduced in 1958.

But now new numbers are coming that will tell you more. The Institute of High Fidelity has just replaced its 1958 tuner-rating standard with

one that takes both stereo and tuner-circuit improvements into account.

The biggest changes involve *sensitivity*, the specification most used to judge tuners. Sensitivity, to be meaningful, should be a measure not just of how weak a signal a tuner can pick up, but of how weak a signal can be and still sound tolerable.

Curves in the chart below show what that means. As FM signal strength (the horizontal axis of the



FM receivers (top) and tuners (above) haven't suddenly changed. But the numbers describing their performance have. Sensitivity ratings will be most altered.

graph) increases, the tuner's audio output level increases quickly to a maximum, and its noise and distortion decline, less rapidly, to their minimum values. The farther the noise curve is below the output, the quieter the sound.

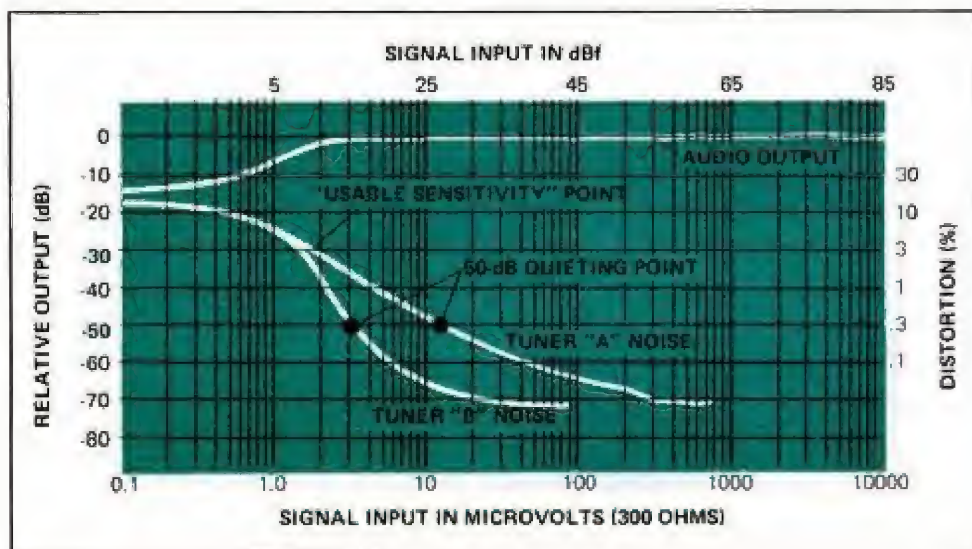
## Disquieting quieting

The old standard rated "usable sensitivity" at the point where the tuner's noise and distortion were 30 decibels (dB) below its maximum output. That makes a tuner look quite sensitive on paper since it doesn't take much signal to produce that much quieting; for our hypothetical tuners A and B, less than 2 millionths of a volt will do it.

But you'll never listen to a 2-microvolt signal with either tuner because a signal with only 30 dB of quieting sounds terrible. It takes about 50 dB of quieting to make an FM program sound good—and while tuner B reaches that point with a mere 3 microvolts of signal, tuner A would need an 11-microvolt signal to get that good.

So the new standards will list the signals required for both 30 dB and 50 dB of quieting. And they'll list

(Please turn to page 186)





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Most FM tuners, instead of having "usable-sensitivity" ratings between about 1.7 and 3 microvolts, will now be rated between 10 and 15 dBf. The lower the numbers, the higher the sensitivity, so figures for "quieting sensitivity" will be even higher, since tuners need more signal for full 50-dB quieting. The rest of the standards will be basically unchanged, but tests behind them will now be more rigorous. ★ ★ ★

dBf	Microvolts	Microvolts	dBf
0	0.55	1	5.2
5	0.97	2	11.2
10	1.7	3	14.7
15	3.1	4	17.2
20	5.5	5	19.2
25	9.7	10	25.2
30	17	20	31.2
35	31	30	34.7
40	55	100	45.2
45	97	300	54.7
50	170	1000	65.2
55	310	3000	74.7
60	550	10,000	85.2
65	970	30,000	94.7
70	1700		
75	3100		
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85	9700		
90	17,000		
95	31,000		
100	55,000		

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**T**rying to make fine frequency corrections with a hi-fi system's bass and treble controls is like trying to shave your mustache with a lawnmower. Try cutting down that boomy mid-bass, and you cut out all the low bass sounds; try lifting the upper mid-range to make the music seem closer, and you turn the treble up to a screech.

But there are tone controls that trim your sound as deftly as a craftsman's carving knife, dividing the frequency range up into as many as five slices . . . or two dozen. Sometimes these controls are built into hi-fi components; more often, they come as separate, plug-in boxes known as "equalizers."

Theoretically, equalizers exist to

make a sound system's response truly equal at all frequencies. In practice, they move you closer to this goal, but what they do best is let you shape the sound the way you want to hear it: warmer, cooler, nearer or more distant, crispier or softer, and with firmer, deeper bass that can shake your socks off, yet

(Please turn to page 199)



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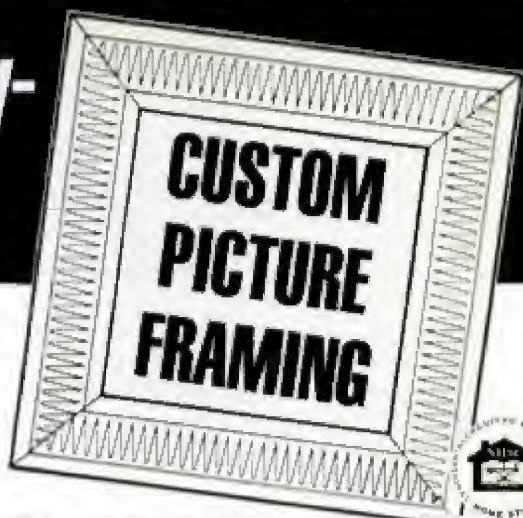
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PM1



## EQUALIZERS

(Continued from page 188)

isn't boomy. And they let you do several of these things at once.

### A rough world for sound

Flat, equal frequency response is a basic goal of hi-fi systems, but except for amplifiers, it's often approximated but rarely achieved. Phono cartridges usually have a little treble peak; speakers are far from flat; even if they were, there probably isn't a living room or den that doesn't overemphasize some frequencies, underplay others and give you a slightly different sound at every seat. Measure the frequency response you actually hear at home, and its graph would be a rough, jagged curve less like a straight line than like a cross section of the Alps.

That doesn't mean you're getting bad sound. The sharpest spikes and chasms on the chart cover too few frequencies for your ear to catch them. And because you're used to listening to natural sounds in your room, you mentally correct somewhat for its contribution to the sound.

But an equalizer can make your good sound even better. (In fact, the better the sound you have already, the more an equalizer can improve it; trying to salvage a bad system with one is a lost cause.)

The most audible defects in your system's frequency response show up as broad, prominent peaks or valleys, or long pronounced slopes. To be audible at all, these have to span at least one-third of an octave.

The fanciest equalizers therefore divide the frequency range up into slices just about one-third octave wide. With such an equalizer, you can flatten down a peak while filling in a valley right next to it, all without altering the balance of the other sounds.

Such elaborate equalizers will alter your bank balance, though: With 20 to 30 controls for each channel, they cost well above \$500. It takes instruments, patience and work to adjust them properly—and if you're smart, you won't touch them again until you change your room or system enough to need new measurements. Altec's \$875 Acousta-Voicette even has a clear panel that screws down over the controls so you can look at but not touch your settings once they have been made.

But it's frustrating to add 48 new controls to your system at over \$18 each, and then not play with them. That's why most equalizers have about 10 bands of one octave apiece. That's still fine enough to deal with

most frequency variations and all the major ones, but few enough controls that you can try to set them by ear, or use them much as you would ordinary tone controls, to alter the sound of a broadcast or recording to suit your taste. Most 10-banders sell between \$200 and \$300, though a few cost more, and there's a nine-band kit from Southwest Technical Products for \$100.

Five-band equalizers naturally cost even less (mostly about \$130, factory-wired, though Heath has an excellent kit at that price, and Ace has a slightly more Spartan one at \$84.25). And they're simpler to use. The bottom control (each one alters two octaves at a time) can add solidity to weak bass—if the speakers can take it without distorting—or reduce hum, rumble and acoustic feedback to the turntable.

The upper bass control can make the sound a little warmer, or a lot less boomy. Turning down the lower mid-range control reduces the nasal, boxed-in sound of many speakers, while turning down the upper mid-range control makes the sound less shrill and harsh; raising these controls makes solo voices stand out more clearly, and the music sound closer. The top control adds crispness and sparkle to the sound, if needed; turned down, it's chiefly used to reduce record scratch and tape hiss.

### All those knobs

Most equalizers have sliding controls whose positions show you at a glance the approximate shape of the frequency curve you've set them to. Usually there are separate sliders for each channel, though the JVC SEA-10's controls affect both channels at once. Separate channel controls let you compensate for the acoustics of asymmetrical rooms, or reduce acoustic feedback by cutting the bass of the speaker nearest the turntable while raising the bass of the other speaker.

You can usually cut or boost each of an equalizer's frequency bands by 12 or 16 dB, which is a lot. So, since even slight misadjustments of the sliders can make a difference, it helps to have a click-stop detent at each slider's zero position. Even more important is a switch that cuts the equalizer out of the circuit altogether. This lets you instantly compare your equalized results with the sound you started with—without such comparison, you can readily get lost in all the possible adjustments and wind up making the sound worse.

Since equalizers are usually con-

nected to a stereo system's tape monitor jacks, most models have duplicate jacks of their own, so you can still use a tape deck. The output from the tape recorder usually goes through the equalizer; but a few models let you equalize the signal before it's recorded, if you wish. That's handy for taping old 78-rpm records, or from any other source that needs frequency correction.

The only other common control is a gain or level-setting adjustment. On some equalizers, it's used to set the input level so that the equalizer won't be driven into distortion. On others, it matches the overall level of the equalized signal to that of the original so that if, for instance, you've had to cut down several peaks, the sound level won't drop when you switch the equalizer in, or jump when you switch it out.

You can adjust a tone control while listening to music, but an equalizer isn't that easy. Since there's always some bass and some treble in a musical signal, tone controls will always have an immediate, audible effect. But the narrower the band being controlled, the better the odds are that nothing will be happening, musically, in the band you're trying to control; then the effect of your adjustment may not be noticeable

(Please turn to page 193)

Equalizers vary in shape and size. Here, top to bottom, are: BSR FEW-1, Ace kit, SWTP kit, BSR FEW-3, Heathkit, Pioneer and Soundcraftsmen models.





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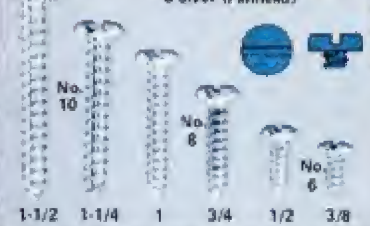
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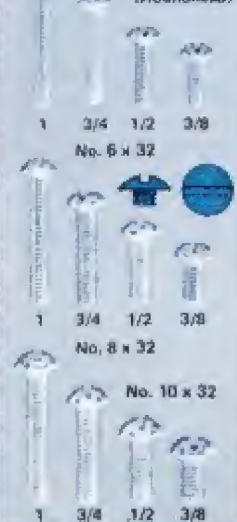
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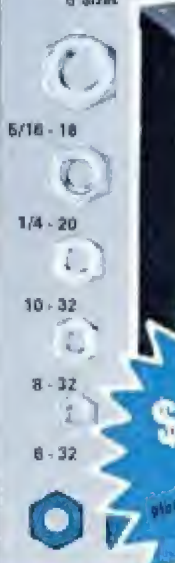
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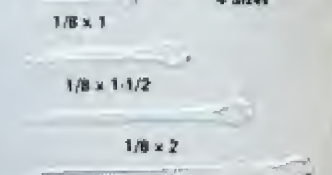
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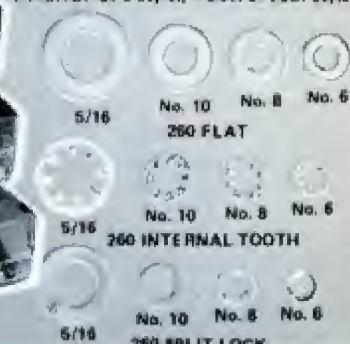
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I used to be an ordinary man. I spent the early part of my life stumbling in the dark, trying to find a way to make all the dreams I had as a young man come true. I wanted, like most young people, to be wealthy, admired, respected. I wanted love and happiness. I also had many questions about life and I wanted some answers. Yet, no matter how hard I tried, everything always seemed to be kept from me. As though it was all hidden in the very next room, a room whose door was impenetrable without the right key.

After years of being kept from those things that I wanted most in the world my spirit could have easily broken if I allowed myself to become consumed with failure and rejection. Little could I know then how lucky I was for this to have happened to me. For something grew inside me that would not let me rest until I found the answers that would bring me all the things I so desperately wanted.

This was the beginning of a search that would become an obsession. To find the knowledge that I so desperately longed for and knew must exist somewhere. The inspiration of the great men of the past took much of the torment away. The multimillionaires and reclusive millionaires that seemed to have the world at their beck and call. The men that were able to control the very destinies of nations. How they held respect and admiration, how they were rich and powerful but not me, never me. What did all these great men have that I didn't? I knew there must be an answer

and I dedicated my life to finding it; because I knew there could be no true life for me until did.

I started to read, to do research into the past. I spoke with and studied of the richest, the most powerful, as well as the wisest men of my time. I read every possible piece of literature that I thought would hold a clue. I delved into the oldest recorded writings of the ancient civilizations. I studied and I learned. Trying almost insanely to put all the pieces of this great puzzle together. I kept asking myself, what did these men have? What did they have that I didn't and how could I get it?

I involved myself in all sorts of situations trying to put into practice what I had learned. I traveled with the hope that the answers might somehow lie beyond the horizon and though I didn't find them there, I know now that the

proverb, "Seek and ye shall find," couldn't be more true. For when the answers were finally revealed to me they came in a way that I could not directly attribute to any place I had been or any individual effort I had made to find them. It was as though my mind had crossed into a new frontier, a frontier that I was certain relatively few men had ever gone into before. Suddenly I saw the whole world differently, what seemed confusing before I could easily understand. What was unobtainable before suddenly became easy to get. The things that people saw one way I saw differently as though I could detect more aspects of the same thing and thereby see it more clearly or as it truly was. I had an undefined power that gave me an advantage over everything I did. After a while I realized that I was very different from before. I was at last the way I wanted to be. I had learned what I wanted to learn and was at long last able to live the way I had dreamed and knew it was possible



The late J. Paul Getty standing in the courtyard of his home at Sutton Place, London. The knowledge, wisdom and experience of this great man is now yours to share, as he intended you to. But it's up to you to make the decision to accept it.

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I would like you to have my secret, but you'll have to realize that this ad will be read by many people, many whom I do not

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With my book, I will also send you a book written by the man who was renowned as the richest man in the world, a man whom I've had great respect and admiration for, the late J. Paul Getty. His book is "The Golden Age." I have bought at great expense, the rights to publish this great

book after Jean Paul's recent and sad departure from this world. I have also printed it in very limited quantities. The book is bound in special library-type binding that should allow it to last for generations to come.

I feel that it is essential you read, along with my book, the message that Jean Paul wanted you to learn...and acquire the truths that took the richest man in the world his entire lifetime to learn.

Therefore, I am making you the following offer: If you feel that after reading my book it is not worth many times more than the mere fifteen dollars you've paid for it, then send it back to me and I will return your uncashed check immediately. Not only that, you can keep J. Paul Getty's book "The Golden Age," for your trouble. You can lose only if

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## EQUALIZERS

(Continued from page 190)

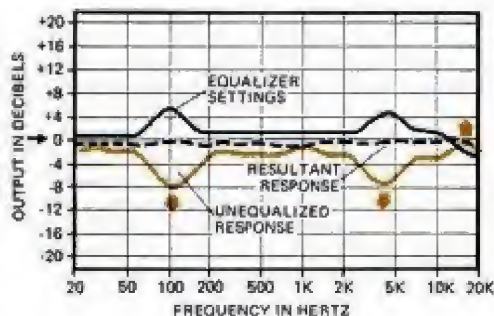
until later, when you're trying to adjust something else.

The best system I've found to set up an equalizer is to use Soundcraftsmen's test record (free with their equalizers, but available for a price separately), which gives you mid-frequency "pink noise" signals in one channel, plus single-octave

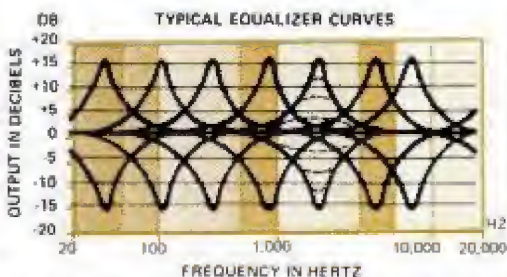
(Please turn to page 194)



Unusual equalizers include horizontal-control MXR (top), JVC with both channels ganged and frequency selectors for top and bottom bands (above), Altec Acoustavoice with 1/3-octave bands (below).



To flatten frequency response, equalizers can provide boosts similar to most dips in system response, as here, or cut back on frequencies where the system peaks.



Family of equalizer curves shows range of boosts and cuts available. These extreme settings, though, are rarely used; dashed lines show more typical settings.

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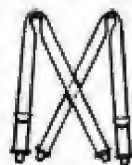
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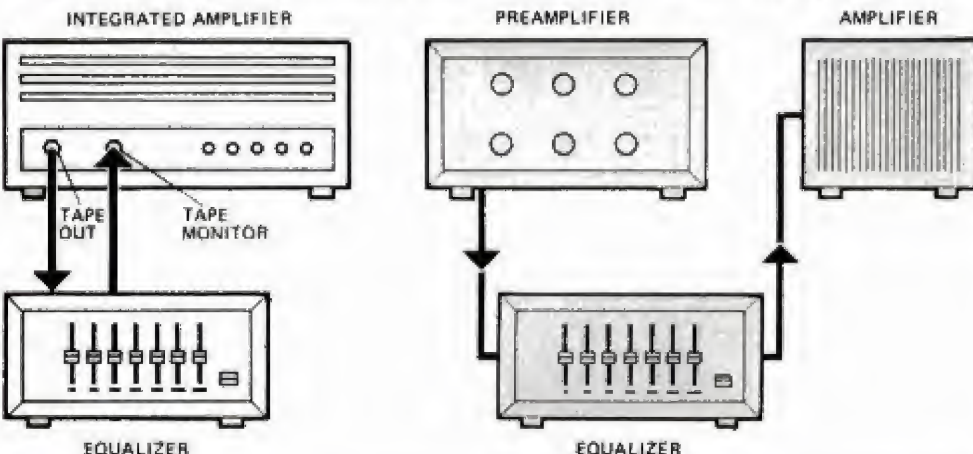


## EQUALIZERS

(Continued from page 193)

pink noise in the other; you adjust the equalizer so that each noise octave sounds as loud as the mid-frequency one. Using my ears to match these levels seems to work better, for me, than using a sound-level meter, though you can get a good one from BSR for \$70. Other test records are available from BSR, CBS, Lafayette, Radio Shack and Ziff-Davis.

**Connecting an equalizer** is simple in most component stereo systems. An equalizer can use tape monitor jacks exactly as if it were a tape deck (most equalizers have duplicate connections so the tape deck can also still be used). It can also connect an amplifier and preamp, or use some receivers' external amp/preamp connections.



If you have an audio generator, you can use that, too: Sweep it slowly through the audio spectrum, noting where you run into peaks that need trimming (you'll probably need a meter to find all but the biggest dips; single frequencies seem harder to use than bands of noise are).

Whatever method you follow, remember to flatten down all the peaks before attempting to fill in the dips (the ear's more sensitive to peaks). And make all your adjustments slowly and cautiously; if you have to

use the full control range of even one of your equalizer knobs, it probably means there's something wrong somewhere. \*\*\*

## HOW THE KITS COMPARE

We built three equalizer kits for this story: the five-band, \$130 Heath; the five-band, \$84.25 Ace, and the \$100, five-band Southwest Technical Products model.

The Ace kit went together easily and quickly, and performed well. It's attractive, and the only kit designed to lie flat on a table, with controls on top. It's available from Ace Audio, 25 Aberdeen Drive, Huntington, N.Y. 11743. There's also an assembled version for \$134.

The Heath was more complex to build, though the super-detailed instructions made it no harder—it just took longer. Heath also has the best troubleshooting instructions, but there was none to shoot. Available by mail from Heath, Benton Harbor, Mich., 49022, and from Heath stores.

The SWTP kit, a real challenge, took eight hours to build. If you are experienced and ingenious at building kits and projects, you'll find it an excellent value. If you're a beginner, pick something simpler. It's available from Southwest Technical Products Corp., 219 West Rhapsody, San Antonio, Tex. 78216.

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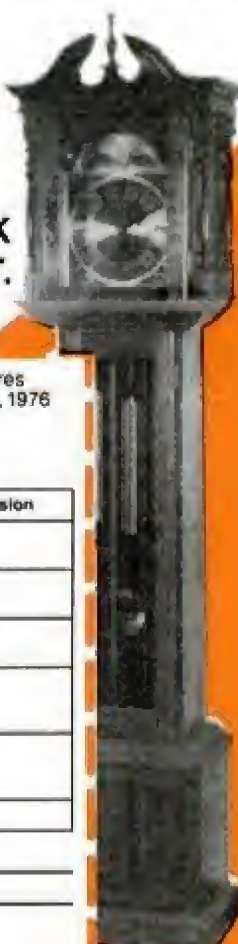
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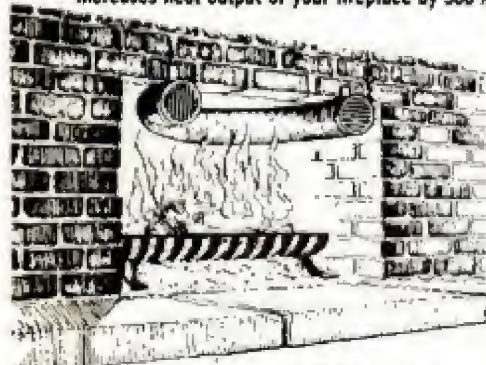
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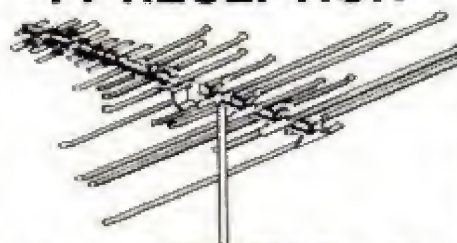
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## FISH

(Continued from page 111)

measures the percentage of oxygen in the water and is worth having.

Many bass fishermen have deserted the shoreline to look for their quarry over the submerged trees, rocks and irregularities called "structure." Saltwater anglers are constantly searching for sunken wrecks or an inlet on the way home. For anglers usually within sight of land, a well-designed hand bearing compass is important for taking ranges and triangulating on a fishing spot that would be difficult to find otherwise. Farther offshore, a good radio direction finder which can identify the direction of coastal radio transmissions is very worthwhile. It can point the way home in bad weather or at night. They run about \$100 up.

### Even Loran is coming

Loran is becoming increasingly popular among fishermen and small-boat owners who head offshore, although at \$1000 and much more it's not for everyone. It provides instant and continuous lines of position that give the user an immediate fix as the Loran receiver measures in microseconds the time it takes pulsed radio signals to travel from two separated pairs of shore stations.

The original Loran A will be phased out in the next few years as it is replaced with Loran C, which is far more accurate, effective over land (thus providing Great Lakes coverage) and longer-ranged. First shut-down of Loran A stations is scheduled for the West Coast, Alaska and Hawaii in mid-1979 and on the East Coast a year later. Combination Loran A and C units, some basically Loran A that will take modification kits, are now being marketed, but some experts feel these will not be as accurate as models designed initially for Loran C. Boats on the East Coast running to offshore underwater canyons and those on the West Coast exploring the Channel Chain areas find Loran indispensable for locating fish and then navigating back home.

### Radar becoming popular

Radar is also gaining popularity aboard small boats. Though at first it may seem out of place, users report that it can make all the difference in navigating, especially in areas that are plagued with fog and low visibility weather. A few years ago a radar dome on a sport fishing boat was a rarity, but today it is becoming commonplace and you will find the characteristic antenna on smaller center-console and tuna tower models as well as the larger offshore





Even the air in the water fish breathe can help spot where they are. Waller Fish Hawk 555 Dissolved Oxygen Meter, \$150, measures oxygen at favorable depths.

boats. Small radar sets cost upward from \$1500, but the benefits are equally great. Making landfalls after dark and running parallel to a shoreline over the horizon are advantages as useful as the well-known safety features of navigating in a fog.

Many less expensive and impressive electrical aids, self-powered or running off the boat's engine battery, can also help a fisherman. Assorted lights and lanterns simplify night fishing. Electric fish scalers and carving knives can make cleaning and filleting easier. A power aerator in a fish well will help keep bait and catch alive. Downriggers for deep trolling are now offered with optional powered winch to get weights and bait down and up with less effort. Some downriggers provide an electronic thermometer so water temperature can be measured to help select and maintain correct trolling depth. Fishermen who are out after deep-water denizens and feel they need help can get electric-powered reels.

#### Consider two-way radio

And then there are those over-worked fishing aids to anglers—the airwaves, where constant radio-telephone chatter can often alert you to where the action is. The fully equipped fishing boat today is likely to have both VHF and citizens band equipment, and since big fish are often far from shore a good marine radio is a worthwhile safety aid if you should need to call for help.

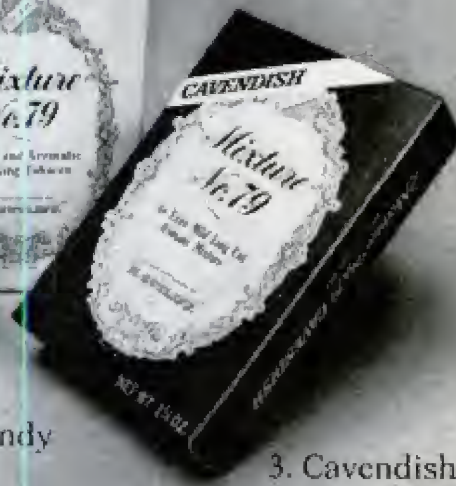
Before electronic fishing aids were invented, of course, no one missed them, but now even small bass boats are beginning to mount extensive gear. For anglers who enjoy building their own, a number of excellent kits are available from Heath Co., Benton Harbor, Mich. The most difficult aspect of the sport of fishing has always been considered to be locating the fish. Electronics can eliminate much of the guesswork. ★ ★ ★

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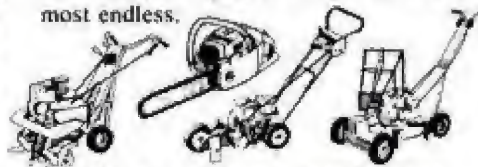
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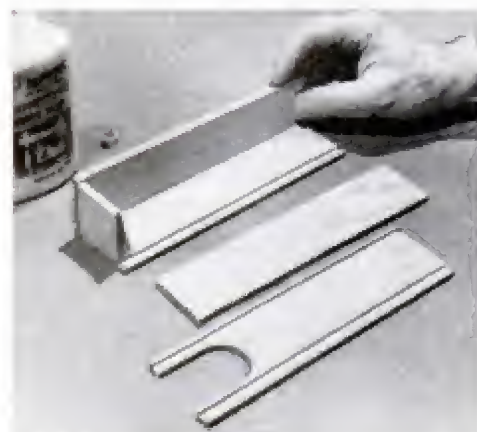
## WORKSHOP PROJECT

# Ball and paddle caddy

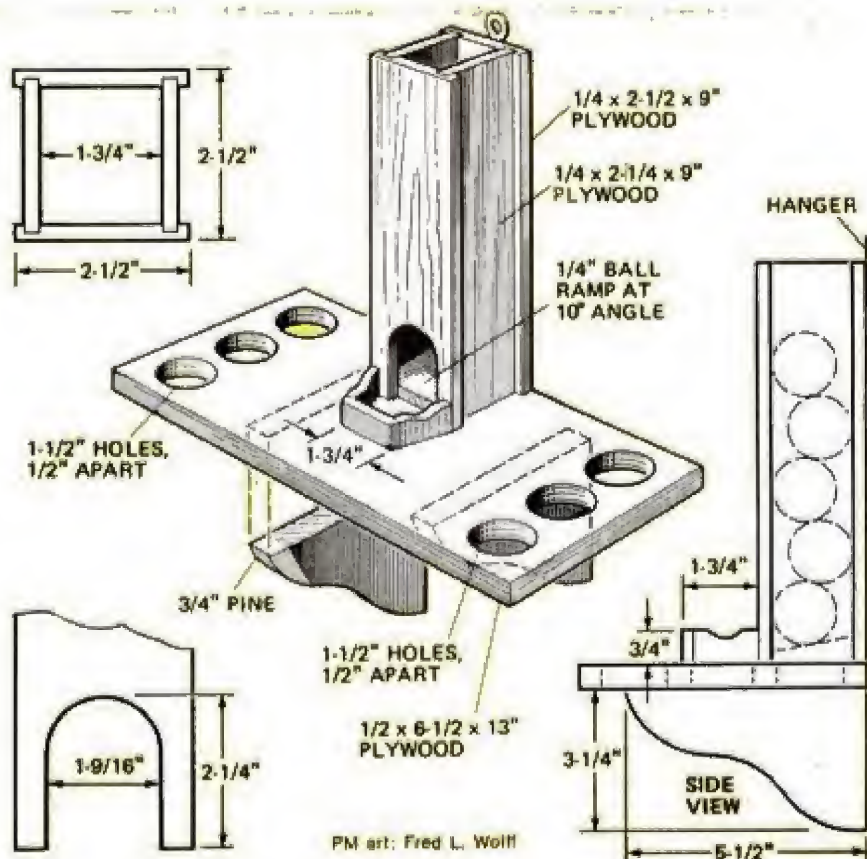


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PM art: Fred L. Wolff



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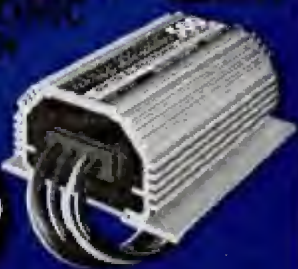
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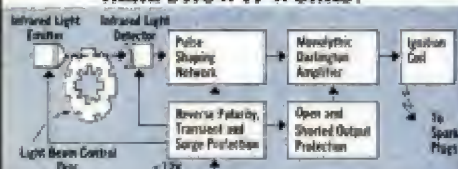
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You could roll the tank by hand, but a far better way is to use Uni-color's motorized \$60 Uniroller, which rolls the tank around one way, then rolls it back again, to avoid the streaks of one-way agitation. Since agitation is continuous, developing time is cut about 15 percent. A color print drum (shown) also uses the Uniroller.—*Ivan Berger*



The process is limited to 20-exposure rolls because it depends on the loose spooling of the film to admit the developing solutions; the much longer 36-frame rolls are too tight. One important preliminary precaution must be observed: When the exposed film in the camera is being rewound, its tapered tongue must be left free so you can turn it back

The Brooks/Sigell tank is \$5 from Porter's Camera Store, Cedar Rapids, Iowa 50613.—*Robert Hertzberg.*



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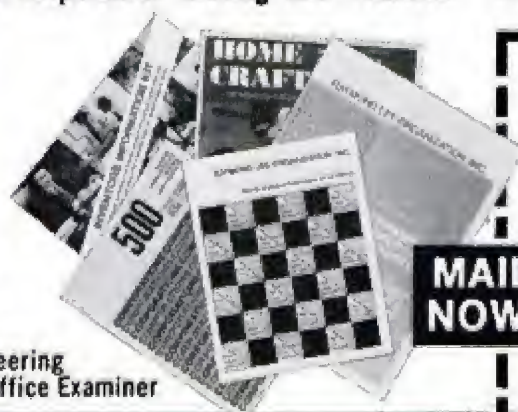


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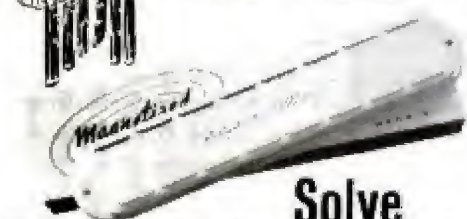
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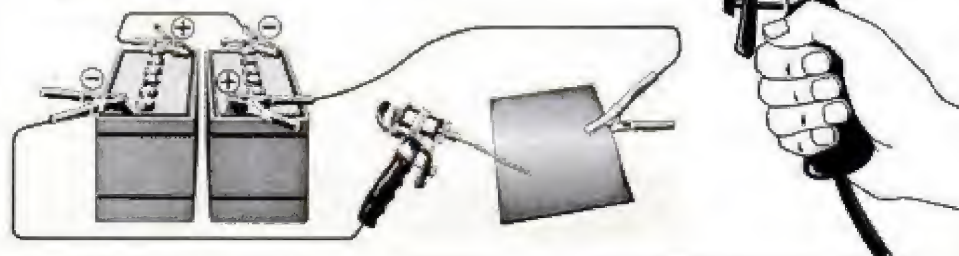
Here's how simple it is to use: With face visor in place, you hold the electrode about 1/2 in. above the metal and lower it slowly until it starts to vibrate rapidly. This produces a succession of arcs which form a weld deposit. Now you move the electrode slightly from side to side as you slowly draw the welder toward you. It's that easy and fun to use. It sells for \$49.95 from P-J Sales, 6975 Washington Ave. South, Edina, Minn. 55435.—Wayne C. Leckey, Senior Editor, Special Projects



Hold welder at 45° angle. Slow rate of travel is best to produce good weld. Keep batteries 4 ft. from work; weld with battery caps removed and protect face with visor or goggles.

Arc-welding kit includes No. 10 standard head with power lead and clip, three-in-one visor, a second cable with clip at ends, Allen wrench, electrodes of various sizes, brazing and soldering wire with flux, spare helical spring and instruction booklet on how to weld.

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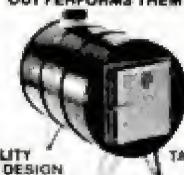
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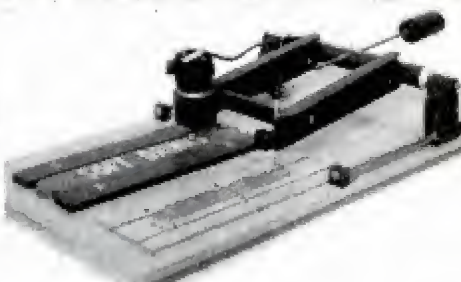
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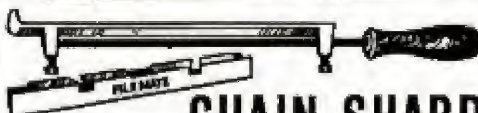
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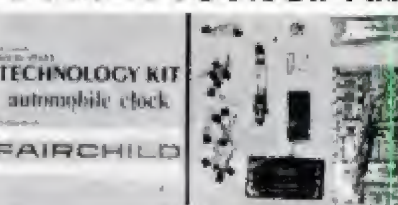
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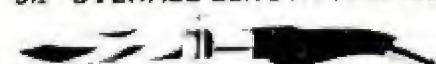


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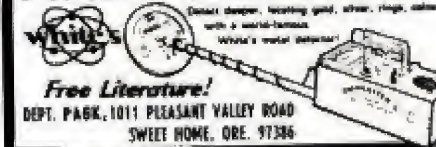


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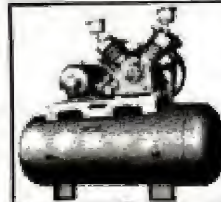
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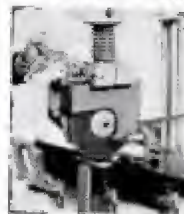


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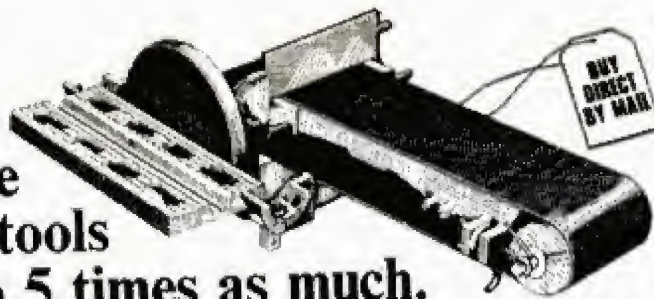
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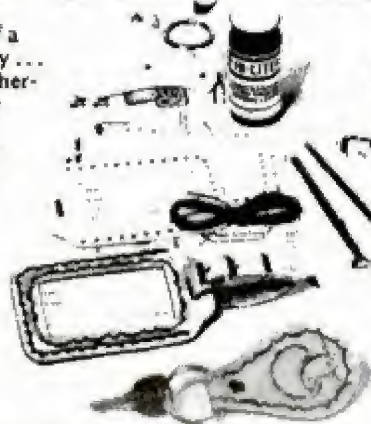


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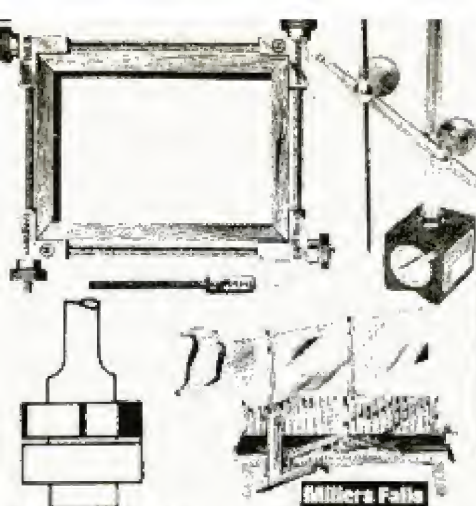
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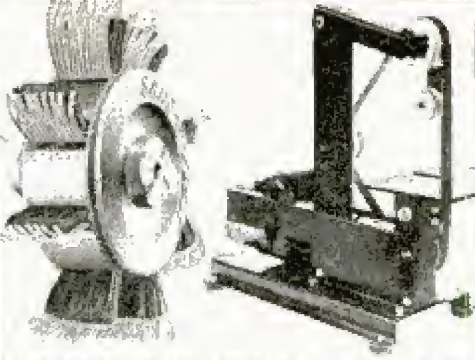
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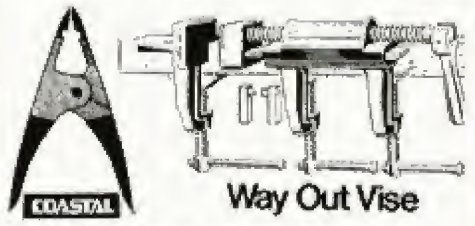
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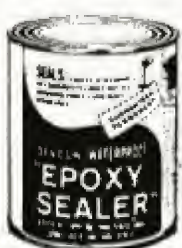
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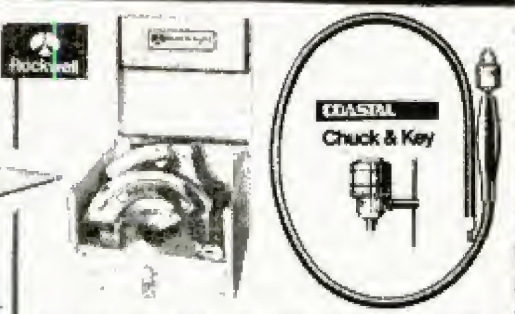
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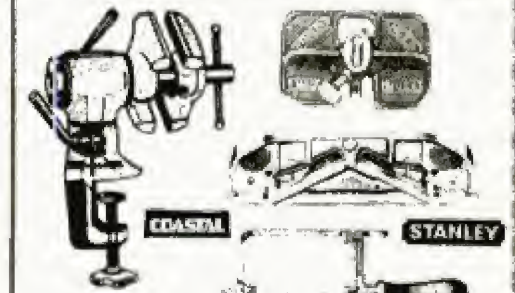


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**GET RICH!** Use other people's money. Be money broker. Write: Milligan Trust, 565-PMN Mohawk, Boulder, Colorado 80303.

**BECOME A MILLIONAIRE** In 90 days using legitimate business procedure virtually unknown to 99% of general public! Detail—send 25¢ to: Schnella, 1811, Box 213, Ruthven, Ontario N0P 2G0.

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**MAKE** Money Selling Proven Synthetic Lubricants. Write: GBS, Box O, Sparks, Nevada 89431.

**MAILORDER—HOW TO BEGIN?** Send for descriptive illustrated folder listing forty publications that guide you to success. Send S.A.S.E. to: R. Sumner, PO Box 83M, Haddon Heights, N.J. 08035.

**\$200 WEEKLY!** Make, Sell Bricks! Free information! Xceto Bricks, 5715 N. Mozart, Chicago, Ill. 60659.

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**I MAKE \$1000.00 Monthly** Mailing Letters. How? Write: Desert Industries, Box 8233-PM Huaiapai Br., Kingman, Ariz. 86412.

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**"HOW** Mailorder fortunes are made!" 258 page hardcover. \$10.00. Free particulars. Small World, 12 Faling Creek, Pittsford, N.Y. 14534.

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**MAIL ORDER** Can turn Spare Time into Cash, at Home. Send 25¢. Forum IV Enterprises, 12410 S.W. Center, Suite 88A, Beaverton, Oregon 97005.

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(Continued on next page)



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(Continued from preceding page)

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**MAKE UP TO \$150.00 A DAY—Polishing Furniture** send \$2.50 for booklet "SHINE YOUR WAY TO SUCCESS" Mirro-Shine Co., Dept. PM5, P.O. Box 123 Williston Park, New York 11556.

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(Continued on next page)



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(Continued from preceding page)

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